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CASE HISTORIES

IN

NEUROLOGY

A SELECTION OF HISTORIES SETTING FORTH THE DIAGNOSIS, TREATMENT AND POST-MORTEM FINDINGS IN NERVOUS DISEASE

BY

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PREFACE.

THE object of this book is to set forth in practical form, on the basis of the Case System, certain fundamental facts regarding the symptomatology, diagnosis, treatment and pathological findings in the more frequent disorders of the nervous system. To accomplish this end, actual cases illustrating definite disease processes or predominating symptoms are narrated in some detail, followed by such explanatory remarks as the individual case demands. Attention has also been given to the important matter of differential diagnosis. The arrangement of the cases has followed the time-honored and useful if somewhat inaccurate anatomical method of division into, (1) peripheral, (2) spinal cord and (3) brain diseases, followed by (4) those for which a definite anatomical basis has not yet been found, and (5) by affections characterized by disorders of function, the neuroses. Very brief explanatory sections on principles of diagnosis and treatment precede and follow the main divisions of the subject matter, which in no way interferes with the primary object of presenting to the reader case histories on the principle developed for medicine by Prof. W. B. Cannon and later put into practical operation by many teachers in Boston and elsewhere. I am indebted to Miss Florence L. Spaulding for assistance in the illustration of the book.

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INTRODUCTION.

GENERAL STATEMENT OF DIAGNOSTIC METHODS.

THE study of the nervous system either under normal or pathological conditions cannot be separated from that of other organs and structures, with which it stands in close relation. The relations with the muscular and vascular systems are particularly intimate, and in general neurology should be regarded as an integral part of internal medicine, demanding special study because of its complexity of structure and function and the consequent variety of its diseases. Certain anatomical and physiological considerations are essential to an understanding of the symptomatology of nervous disease, which is a departure from the normal, either on the side of structure — organic or structural disease — or on the side of function — so-called functional disease.*

In undertaking a systematic elementary study of disorders of the nervous system on the basis of actual cases, it is desirable briefly to consider its three fundamental functions: *A*. MOTION; *B*. SENSATION; *C*. MIND, from an anatomical and physiological standpoint.

MOTION.

Anatomical and Physiological Considerations.

The path of voluntary motion originates in the cerebral cortex, chiefly in the convolution ventral to the fissure of Rolando and extending from the fissure of Sylvius to the vertex of the brain (Fig. 1). Thence the axones are concentrated into a compact bundle which passes through the ventral portion of the dorsal limb of the internal capsule,

* These are terms of convenience. A sharp distinction is not to be drawn between structural and functional disease.

from there into the central portion of the pes pedunculi, through the pons, where its fibers are separated by the transverse fibers of that structure, finally emerging, as the ventral pyramid of the oblongata, and, after crossing in its lower part, passing into the spinal cord as the crossed pyramidal tract.

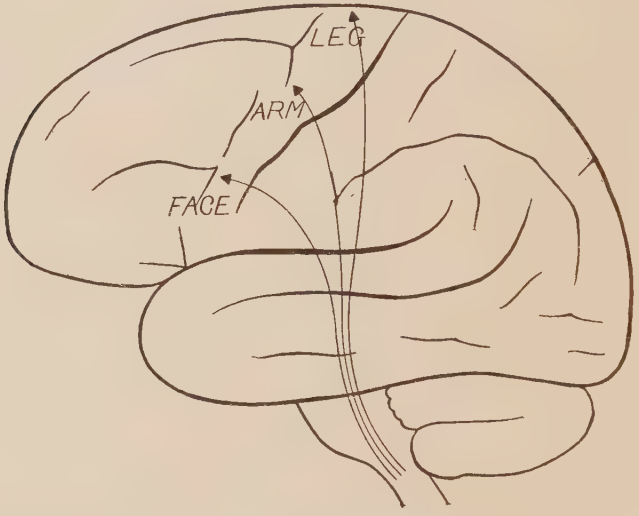


Fig 1. Cortical Motor Areas.

The pathway is continued to the muscles from the ventral horns of the cord (and also from the motor cranial nerve ganglia), ultimately terminating in the plates of the skeletal muscles.

The motor system, therefore, consists of two neurones, variously known as the corticospinal motor neurone, — central neurone, neurone of the second order, and the spinal-peripheral, — peripheral or motor neurone of the first order. The connection between them in the ventral gray substance is through collateral branches from the pyramidal tracts to the dendritic processes of the cell bodies of the peripheral neurones. Whatever the exact anatomical relations may be, the important practical point is that the physiological connection between the central and peripheral motor neurones is complete, and that any break in this connection leads to motor defect.

In order that voluntary movements may be performed, the integrity of the entire motor tract, from center to periphery,

is essential. If through disease or injury the path of conduction is interrupted at any point in the course of either of the neurones, paralysis (complete loss of power) or paresis (partial loss of power) results. *Injury of either peripheral or central motor neurone therefore leads to paralysis.*

Peripheral Motor Neurone. The peripheral or spinal-muscular motor neurones extend from cell-bodies in the ventral horns of the cord, or from the corresponding nuclei of the motor cranial nerves, to the various voluntary muscles. The integrity of the muscles is dependent upon the integrity of the motor nerves. The muscles and the motor nerves must, therefore, always be considered together as parts of a single mechanism. Destruction, or serious injury from whatever cause, of the peripheral motor neurone leads to *muscular atrophy*, and this to a lack of tonicity (hypotonicity) or to a *flaccid* paralysis. Associated with this condition are *alterations of electrical reactions*. Finally, disease of peripheral motor neurones gives rise to disturbances (diminution, loss) of the so-called deep or tendon reflexes, among which the knee jerk may be taken as the most practically important.

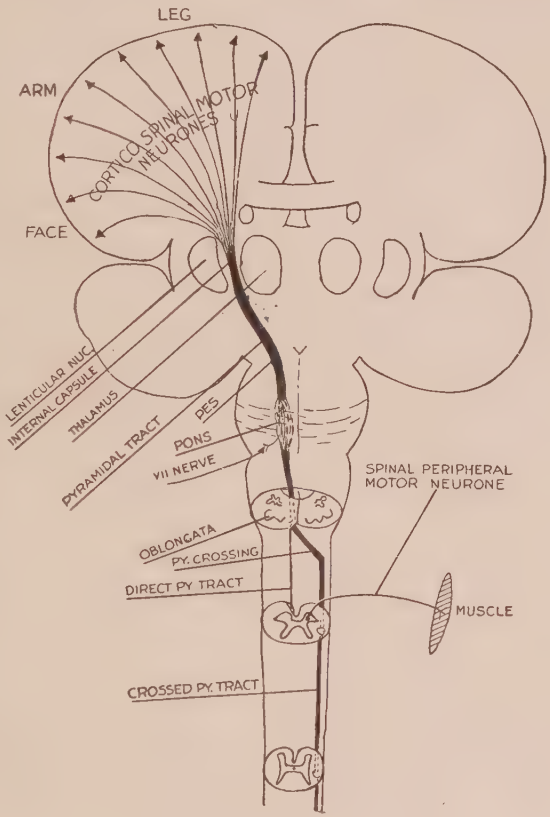


Fig. 2. Motor Tracts.

Mechanism of the Knee Jerk. (Whether the knee jerk and allied phenomena are true reflexes, or dependent simply upon muscular tonicity, or what the exact physiological mechanism of the human reflexes may be, are matters unessential to an understanding of clinical conditions.)

For the carrying out of a reflex (knee jerk) an intact reflex arc is essential. This consists of a sensory pathway, and a motor pathway, connected in the central organ (gray matter of cord). An interruption of the arc in any part of its course (Fig. 3, xxxx) will abolish the reflex. Hence disease of the peripheral motor neurones, including the reflex arc of the knee jerk, abolishes that reflex. A similar result naturally follows disease of the sensory neurones essential to the reflex (tabes dorsalis) and also disease of both sensory and motor neurones in the nerve trunk (peripheral neuritis).

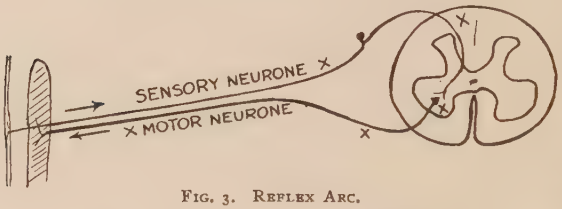


Fig. 3. Reflex Arc.

When, on the other hand, the regulatory mechanism from the brain to the lower reflex arc is interfered with — degeneration of the pyramidal tracts, or corticospinal motor neurones — the reflexes are increased, presumably through cutting off of inhibitory influences.

Electrical Changes. Under normal conditions nerves and muscles may be stimulated to contraction by both the faradic (interrupted) and galvanic (constant) currents. The responses are quick. Under pathological conditions — degeneration of the peripheral motor neurone to the muscle — the contractions are altered both in quantity and quality. If merely a stronger current is required than usual, the change is spoken of as *quantitative;* if the character of the contraction is changed and the reaction to the two poles of the galvanic current is altered, the condition is spoken of as *qualitative*, or *Reaction of Degeneration* (R. D.).

Normally, (1) stimulation of a nerve trunk by a faradic current (indirect stimulation) produces a quick contraction of the muscle or group of muscles supplied by that nerve.

The point of best stimulation is known as a motor point. (2) Stimulation of a muscle itself (direct stimulation) produces a quick contraction. The poles of the faradic current need not be distinguished.

Stimulation of a nerve by the galvanic current produces a quick contraction. Stimulation of a muscle likewise produces a quick contraction. This contraction is more easily produced when the negative (cathode) pole is used for stimulation.

The normal formula may be expressed as follows:

Faradism { Nerve — quick contraction.
Muscle — quick contraction.

Galvanism { Nerve — quick contraction.
Muscle — quick contraction.
With CaC (negative closing contraction) greater than (>) AnC (positive closing contraction).

Under pathological conditions neither stimulation of the nerve nor of the muscle by the faradic current produces a contraction. Galvanic stimulation of the nerve also produces no muscular contraction (conductivity of the nerve lost), but applied to the muscle produces often an exaggerated but a changed response. The contraction is *slow*, wavelike, and the positive pole has as great as, or greater stimulating effect than the negative pole.

The pathological formula (R. D.) may be expressed as follows:

Faradism { Nerve — no response.
Muscle — no response.

Galvanism { Nerve — no response.
Muscle — active response with qualitative changes.
Slow contraction, AnC, equal to or greater than ($\overline{=}$) CaC.

There are various stages between the normal and complete R. D., known as partial R. D.

Disease of the peripheral motor neurone, therefore, gives rise to the following objective conditions: 1. *Paralysis.* 2. *Muscular atrophy.* 3. *Flaccidity* with *hypotonicity.* 4. *Lost deep reflexes.* 5. *Electrical alterations* (*R. D.*). Flaccid, Atrophic Paralysis.

Central Motor Neurone. Disease or injury of the central or corticospinal motor neurone, except for the common element of weakness (paralysis), differs widely in its clinical manifestations from that of the peripheral motor neurone just considered. Inasmuch as it has no direct connection with the muscular system, injury or disease does not produce muscular atrophy and electrical alterations; the muscular system instead of being hypotonic is *hypertonic*, and, finally, the deep reflexes are exaggerated instead of diminished. The hypertonicity and exaggerated reflexes, e. g., knee jerk, are due to the loss of the controlling influence of the brain, through the degeneration of the motor pyramidal tracts. Since the lower reflex arc is unaffected, and the regulatory, inhibitive influences of the brain are removed, the reflex overacts and an increased knee jerk results. Marked exaggeration of the knee jerk points to disease of the central motor tracts.

Disease of the central motor neurone, therefore, gives rise to the following conditions: 1. *Paralysis.* 2. *Spasticity* with *hypertonicity.* 3. *Exaggerated deep reflexes.* And negatively: 4. *No muscular atrophy.* 5. *No electrical alterations.* Spastic, Non-Atrophic Paralysis.

Disease of the two motor neurones may be graphically represented as follows:

Peripheral Neurone.
- Muscular atrophy
- Hypotonicity
- Diminished reflexes
- Electrical alterations

} Flaccidity

Central Neurone.
- Increased reflexes
- Hypertonicity
- No atrophy
- No electrical alterations

} Spasticity

} Paralysis

Disease of the motor neurone system may, therefore, manifest itself either as a flaccid, atrophic paralysis (progressive muscular atrophy), or as a spastic paralysis (spastic paraplegia), or as a combination of the two types (amyotrophic lateral sclerosis). See later discussion.

SENSATION.

Anatomical and Physiological Considerations.

The path of common sensibility from the periphery to the brain lies in the sensory portion of the mixed nerves, or in the nerves of special sense, and reaches thereby the cord or brain stem, passing finally to the higher levels of perception in the brain cortex. Anatomically the sensory system consists of at least three superimposed neurones, the lower or peripheral of which is alone of special practical diagnostic importance. The sensory tracts cross in the central system, in part in the cord and in part in the oblongata. The general course of the main sensory fibers in the cord is represented in the accompanying diagram (Fig. 4). It is probable that those fibers which subserve the senses of pain and temperature cross soon after entering the cord, whereas those which subserve the sense of contact and position pass up mainly in the long dorsal tracts (columns of Burdach and Goll).

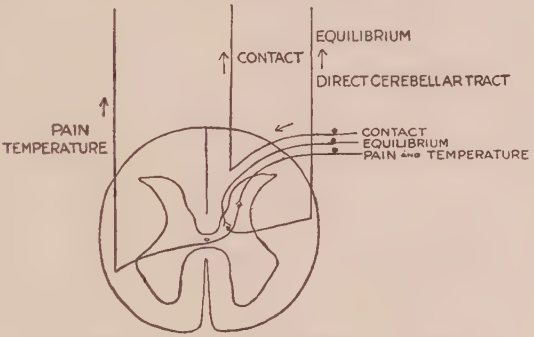


FIG. 4. COURSE OF MAIN SENSORY NEURONES.

Peripheral Sensory Neurones.

The integrity of this system of neurones is essential to the preservation of normal sensibility. Disease or injury of these neurones, therefore, causes various disorders of sensory perception in the skin areas supplied. The more frequent of these disorders are, analgesia — loss of pain sense; anesthesia — general loss of sensibility; hyperesthesia — increased sensibility; paresthesia — unusual sensations, e. g., prickling, formication, burning, etc.

Disturbance of co-ordination depends upon the sense of position, which, in turn, is dependent upon the joint sensation subserved by the peripheral sensory neurones.

Disturbed sensation is of much value in determining pathological processes, localized in the brain, certain segments of the spinal cord or in the periphery. The trophic functions of the skin also frequently suffer. Inasmuch also as the superficial reflex arc is partially constituted by the sensory neurones, it follows that a destruction of these neurones leads to an abolition of the deep reflexes (knee jerk) for the same reason that a destruction of the motor peripheral neurones leads to their abolition. Disease of the peripheral sensory neurone, therefore, gives rise to the following conditions: 1. *Disturbed sensibility.* 2. *Lost deep reflexes.* 3. *Trophic disorders.*

Disease of the upper sensory neurones is of less significance from the diagnostic standpoint.

The important areas of the spinal cord from a clinical standpoint are those tracts of fibers which are made up by motor neurones of the peripheral and central type, and by sensory neurones of the peripheral type. Diseases of these regions alone or in combination give rise to the varied signs and symptoms met with in organic disease of the spinal cord.

From the accompanying diagram (Fig. 5), having in mind the functions of the two motor tracts and of the peripheral

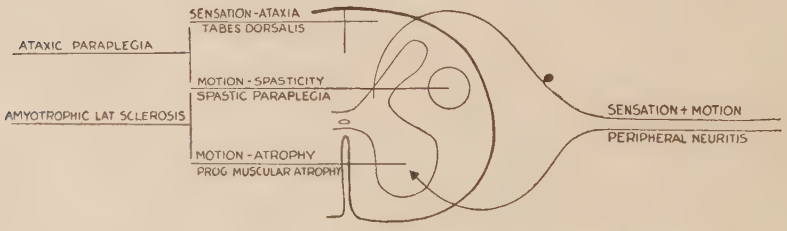


Fig. 5. Diagram Illustrating Cord Functions and Disease Processes.

sensory tract, it is evident that the diagnosis of many affections may be understood which may be summarized as follows:

If the peripheral motor neu[illegible] affected, either through primary disease of the neurones, — progressive muscular atrophy, — or through destruction of the nerve cell bodies lying in the ventral horns, — anterior poliomyelitis, — a

flaccid, atrophic paralysis results, with electrical changes and diminished deep reflexes, but without sensory disorders.

If the central motor neurone is involved, a spastic, non-atrophic paralysis results, with exaggerated deep reflexes, also without sensory disorders, — spastic paralysis.

If the sensory peripheral neurones are involved, a condition of disturbed sensibility results, with incoördination and loss of deep reflexes (ataxia, tabes dorsalis), but without motor weakness.

If the peripheral and central motor neurones are both involved, a spastic, atrophic paralysis results, certain groups of muscles, usually in the upper part of the body, being atrophic with lost deep reflexes, and other groups — legs — being spastic with increased deep reflexes (amyotrophic lateral sclerosis).

If the peripheral sensory neurones and the central motor neurones are together involved, sensory disorders with ataxia are combined with spastic conditions, giving rise to the symptom-complex of ataxic paraplegia.

Finally, if the mixed nerve is involved in its peripheral distribution, an atrophic paralysis with sensory symptoms will result, as a consequence of a combined lesion of the peripheral motor and peripheral sensory neurones, with loss of deep reflexes, in this case the reflex arc being doubly interrupted (peripheral neuritis).

The foregoing disturbances are best studied in the spinal cord, but the same principles apply to various lesions of the brain stem, implicating cranial nerves (bulbar paralysis, ophthalmoplegia).

In all these affections, in which the lesions are so combined that one process, e. g., degeneration of the sensory tracts or the peripheral motor neurones, would tend to destroy the deep reflexes (knee jerk), and the other, e. g., degeneration of the central motor neurone (pyramidal tracts), would tend to increase the deep reflexes, the resultant condition will depend upon the relative extent of the antagonistic processes. A knee jerk, for example, may be increased early in the course of an ataxic paraplegia, and later lost, as the reflex arc itself becomes involved.

MIND.

Study of the function of mind is the primary work of psychiatry. It has, however, become increasingly apparent that many of the neuroses are more profitably approached from the mental side. Hence neurological diagnosis demands a clear recognition of the influence and broad significance of mental states in the etiology and treatment of certain frequent forms of nervous disease. The practical application of this knowledge is indicated in the case histories (Section V).

TYPES OF PARALYSIS.

Owing to the anatomical relations of the motor tracts, both central and peripheral, the position of a lesion is indicated by certain somewhat definite types of paralysis. Of these the more important are as follows:

Monoplegia — paralysis of a single extremity — is caused by a destructive lesion of the cerebral cortex, because of the wide distribution of motor function on the surface of the brain. A lesion sufficiently extensive to produce a cortical hemiplegia in an adult would in most instances be destructive of life. Exceptions to the general rule may occur, as in young children or in a gradually increasing hemorrhage from a meningeal artery.

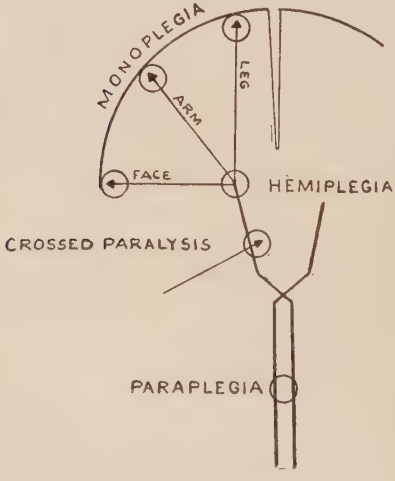


Fig. 6. Types of Paralysis.

Hemiplegia — paralysis of one side of the body, including the face — is caused by a lesion in or about the internal capsule which destroys the motor fibers in their passage downward. The fibers converge at the capsule; hence a small lesion is capable of producing an extensive defect. The opposite side of the body alone is involved, since the tracts for the two sides are still widely separated.

Crossed Paralysis. Lesions of the crura and pons may lie in such a position that the fibers of one of the cranial nerves, third, sixth or seventh, are invaded after they have crossed, whereas the fibers of the pyramidal tract are interrupted before they have crossed, with the result that the muscles of the eye or face are paralyzed on the same side as the lesion, and the arm and leg on the opposite side.

Paraplegia — paralysis of both sides of the body — points toward a lesion of the cord. Since the size of the cord is such that the two motor tracts lie close together, a lesion of sufficient intensity to destroy one tract is liable to destroy both.

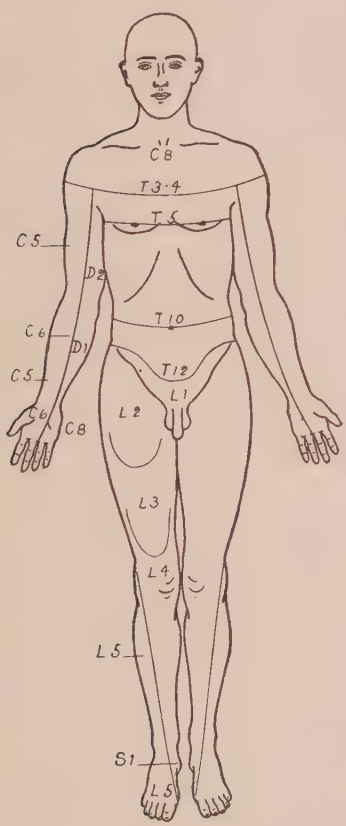
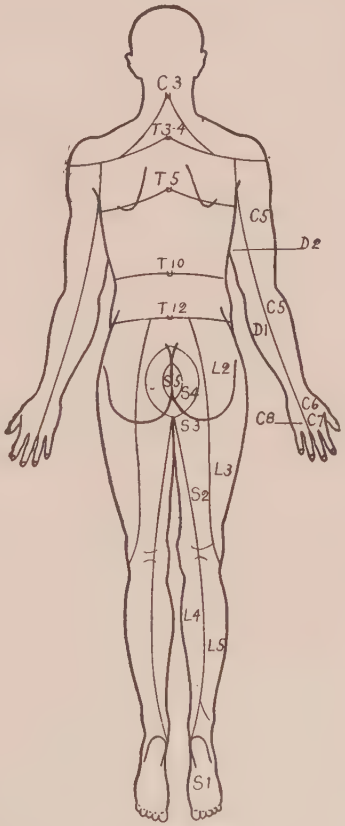


FIG. 7. SEGMENTAL DISTRIBUTION. FIG. 8.



Segmental Paralysis. If the lesion be in the ventral horns of the cord or between the cord and the plexuses, cer-

tain groups of muscles normally acting together will be paralyzed.

Individual Nerve Paralysis. If the lesion lie peripheral to the plexuses, those muscles supplied by the special nerve involved will alone be paralyzed.

The same principles apply in general to the sensory system. The significance of segmental distribution as contrasted with that of individual peripheral nerves is somewhat greater in the case of sensation than in that of motion. This segmental sensory involvement is especially important in determining the exact level of destructive lesions of the spinal cord. The general distributions are indicated in the accompanying diagrams (Figs. 7, 8), from which it will be seen that with the arm extended from the side, the upper side of the arm and hand are supplied by the upper segments and that the anterior portion of the leg and thigh is supplied by higher segments than the posterior portions. Owing to the interposition of the plexuses, the individual nerve distribution corresponds roughly but not exactly to the segmental distribution.

SECTION I.

PERIPHERAL NERVES.

THE phrase "peripheral nervous system" is to be regarded rather as a clinical terminology than as a statement of anatomical structure. The term is ordinarily used to define that portion of the nervous system which lies without the central mass of the brain and cord. It is evident, however, that the neurones constituting peripheral nerves so far as they are motor have origin from cell bodies within the brain and cord, and so far as they are sensory send fibers into the central system. The term "peripheral nerve" is, therefore, one of clinical convenience rather than one of anatomical accuracy.

General Symptomatology. Inasmuch as the peripheral nerves are mixed, symptoms referable to them are both motor and sensory, an important diagnostic distinction between peripheral and certain central lesions. Since both motion and sensation are involved in lesions of the peripheral nerve, the paralysis resulting is of the flaccid atrophic type with added disorders of sensation characterized by pain and tenderness if the lesion be inflammatory and by anesthesia if the lesion be destructive (see p. 16).

Case 1. N., a married woman of twenty-six, had in general been well up to a year before being seen. About a year previously she began to have trouble with her stomach. It was difficult for her to retain food. For three years she had been drinking to excess, — wine, whiskey and cocktails. Four weeks before being seen she was obliged to take to her bed. She claimed to have had no alcohol for five or six weeks. She was vomiting. A few days previously she had had a transient diplopia with some blurring of vision, but without headache. For four days she had noticed pain and numbness, especially of the legs, extending, however, in some degree to the arms.

Examination showed normal pupils and no cranial nerve palsies. In the arms there was some pain on deep pressure over the musculospiral nerves. Her hands felt numb, but objectively there was no disorder of sensation. The hand grasp was good. The abdomen was painful on general pressure and there was no abdominal reflex. The liver was not noticeably increased in size. In the legs there was marked tenderness over the anterior crural and sciatic nerves, with probable blunting of sensation in the legs and distinct disturbance of the sense of position in the toes. The knee jerks were lost; there was no clonus, Achilles or plantar reflex. Flexion of the ankle was imperfect, the legs were weak. There was no sphincter disturbance. She complained of failing memory.

Diagnosis. In view of the history of alcoholic indulgence and the supervening symptoms, this case is undoubtedly one of general Neuritis due to alcohol. In favor of this diagnosis is the weakness and tenderness over nerve trunks together with slight objective but predominant subjective disorder of sensation without disturbance in pupillary reaction or in the control of the sphincters. The lost deep reflexes are explained by an interruption of the reflex arc through injury to the mixed nerve (see page 14). In favor also of the diagnosis of neuritis is the general muscular weakness; failing memory and transient diplopia, although not characteristic of uncomplicated neuritis, are not inconsistent with that diagnosis.

Prognosis and Treatment. Abstinence from alcohol together with supportive and general hygienic treatment, combined with strychnia and massage in the later stages, usually results in cure. If neglected, the paralysis may become complete, contractures are apt to develop during convalescence, and in certain severe cases some permanent motor defect may remain, due to the retrograde degeneration of the cells of origin of the motor nerves in the ventral horns of the cord.

Case 2. E., thirty-four years old, was first seen September 26, 1904. He was a gambler and "politician" and had indulged in all sorts of excesses since youth. He had undoubtedly had syphilis. For the past ten years he had taken alcohol in great excess, averaging for the previous five years about fifteen drinks of whiskey a day. About six years before, a diagnosis of tabes dorsalis had been made by a physician of high standing. He improved, however, but four years ago was again in bed with difficulty in walking. For some years he had had sharp pains, described as a sensation of hot iron boring into the flesh. For several weeks past he had had increasing ataxia, finally preventing his standing without assistance. There was no complaint of sphincter disorder and, except for some general weakness, he was not conscious of loss of muscular strength.

Examination showed a normal light and accommodative response. There was an excessive swaying with the eyes closed (Romberg sign) and much objective disturbance of sensation in the feet, legs and thighs. There was also disorder of the sense of position of the toes. The knee jerks were absent. There was no plantar or Achilles reaction. The abdominal and epigastric reflexes were obtained. Both arms and legs were highly ataxic and the hands also were somewhat numb. When supported on both sides, he walked with a typically ataxic gait. There was a slight apparent loss of memory, but no slurring of words and no defect of speech suggestive of dementia paralytica.

A diagnosis of tabes was made and Fraenkel coördinative exercises prescribed. His improvement was rapid. On May 16, about eight months after the first visit, he had practically recovered. Examination at that time was in general as follows:

There had been some lancinating pain in the shoulder and occasionally in the right foot, especially in damp weather. The sense of numbness had practically disappeared; his memory was restored; there was no ataxia of the arms; no Romberg sign; the knee jerks were distinctly present, though not very active. The pupils were rather wide, but reacted properly. Slight pain on deep pressure was noted in the

right calf and about the ankles. Sense of position, pain and contact in the feet were normal. About three months later still further improvement was apparent. There was no sensation of numbness, no more shooting pains, no Romberg; the knee jerks were active. There was, however, slight tenderness on deep pressure in the left calf, with an occasional cramp and dull pain.

Diagnosis. In this case a wholly erroneous diagnosis of tabes was made, and its importance lies in this possibility. The improvement and recovery show that the condition was due to alcohol, although so closely resembling tabes in its symptomatology. It is a good example of so-called Peripheral Pseudo-tabes and illustrates certain points common to a peripheral and central lesion. Absent knee jerks, subjective and objective disorders of sensation, together with the Romberg sign, sharp pains and uncertainty of gait, are all common to the two conditions. Argyll-Robertson pupils (failure to respond to light with retained accommodation) and sphincter disorders do not occur in peripheral neuritis and did not occur in this case. It is, however, possible for tabes to run its course without involvement of the light reflex, hence the absence of this sign alone should not be given undue weight if other signs point to tabes. The absence of the sphincteric disorder should be given more weight in arriving at a diagnosis. The case furthermore demonstrates that lancinating pains very characteristic of tabes may occur in identical form in peripheral neuritis. Motor weakness and pain on deep pressure over the nerve trunks, together with sensitiveness of the skin, were not conspicuous and hence confused the diagnosis. The outcome of the case in recovery taken in conjunction with an adequate antecedent history of alcoholic excess, and especially the return of the knee jerks, must be regarded as decisive evidence that the condition was a neuritis rather than tabes, although a slight suspicion may still be permitted that a combination of the two conditions may have existed.

Prognosis. The patient ultimately recovered completely.

Treatment. Withdrawal of alcohol and general hygienic measures in this case resulted in apparent cure.

Case 3. U., an unmarried work-girl of twenty-two, took Paris green with suicidal intent September 7, 1907. She was taken to a hospital, unconscious. On recovering consciousness she had much epigastric pain, together with much general pain; she was distressed by food; her temperature was 99, pulse 96, respiration 26. She complained of a burning sensation extending from her throat to her stomach, with nausea. In five or six days there was a gradual loss of power in the hands and arms, followed by a similar condition in the legs, associated with much pain.

Examined about two months later, the following conditions were noted. The pupils were normal and there was no involvement of any cranial nerve. There was extreme paralysis of the extremities, the legs being somewhat more affected than the arms. The arms and hands showed the most excessive wasting. Movements of the shoulder were possible, at the elbow very slight, and practically lost in the hands. The fingers of the left hand could be slightly flexed; there was complete wrist drop on the right; almost complete on the left. There was extreme pain over all the nerve trunks and over the muscles. Pain, temperature and sense of position were all reduced in both hands. The arm reflexes were not obtained. Except for general emaciation, the body showed no definite atrophy. There was no abdominal reflex. The legs were wasted almost to the last degree. There was slight flexion and extension at the hips and knees, with complete foot-drop on both sides; movements of the feet were impossible. The knee jerks were lost; there was no Babinski, plantar or Achilles reflex. On passive movement there was complaint of extreme pain, and the nerve trunks were everywhere sensitive. With some difficulty she was, however, able to sit up. The heart showed nothing abnormal. Later, under persistent treatment by massage and exercises, she improved materially and finally was able to feed herself with her left hand to some degree and moved that arm with increasing freedom. On December 30 she was still unable to stand and complained of tingling and pain in the hands and feet. Subsequently she has improved still more, but to exactly what degree is not known. The sphincters were not involved.

Diagnosis. The effect of arsenic in poisonous but not fatal doses is well shown in this case of generalized Neuritis following the ingestion of Paris green in sufficient quantity to produce unconsciousness. The extreme atrophy of the muscles in this case, reducing the patient practically to a skeleton, with lost reflexes and pain, but with a remarkable sparing of the cranial nerves, is again characteristic of a multiple peripheral neuritis. Freedom of the sphincters is also noteworthy.

Prognosis. The prognosis of this case is good as regards life, but it is probable that the peripheral axones were so severely affected that their cells of origin will be permanently injured. In such instances, certain muscular defects persist.

Treatment. Massage and passive movements, gentle at first, and later more vigorous, resulted in this case in decided improvement. (See also general remarks on the treatment of peripheral lesions.)

Case 4. R., a married man of sixty-three, noticed that his hands were numb during the latter part of 1909. The early part of January the numbness had extended to his feet. He felt somewhat nauseated, but did not vomit. He had no temperature; his pulse was about 120; his respiration, heart and lungs normal. The liver extended to about one inch below the costal border. He was a very large eater and weighed 235 lb. He did not smoke and gave no history of alcohol in excess. The urine was negative and the bowels sufficiently normal. The numbness and weakness increased steadily so that early in January he was hardly able to get out of bed.

Examination showed a man mentally perfectly normal, but practically helpless. There was no lead line on the gums nor had there been a history of colic. The pupils were equal and normal in all respects. The cranial nerves showed no abnormality beyond a slight deafness of long standing. There was no headache or other cerebral symptom. The arms were very weak and all movements of the hands and arms were performed with difficulty. There was definite atrophy, especially of the small hand muscles. There was pain, though not extreme, on deep pressure over the upper arm, with definite blunting of sensation and marked ataxia of the hands. The abdominal reflexes were not obtained. There was some possible dulling of sensation below the umbilicus. There was no sphincter disorder whatever. The legs were both extremely weak, with considerable pain on deep pressure over the sciatic nerves. The knee jerks were lost, the plantar reflexes not obtained; there was no Achilles reflex and no clonus. There was marked objective numbness of the feet, growing gradually less up the legs, with marked disorder of the sense of position in the toes. He was unable to stand. There was no pain while lying still. The blood pressure was 130.

Diagnosis. This case is evidently one of Multiple Neuritis, but of uncertain etiology in view of the fact that an excessive use of alcohol is denied. In susceptible persons, however, the steady use of small amounts of alcohol over long periods of time is undoubtedly sufficient to produce an ultimate neuritis. The cranial nerves are rarely affected in neuritis of this general type for reasons which have not been definitely

established. Lead poisoning is seldom associated with the degree of pain and sensory disturbance which this patient presented.

Prognosis. For a time the condition grew decidedly worse, then improvement began, which has resulted in practically complete restoration to health. In these cases the tendency toward recovery is strong.

Treatment. The patient was kept in bed, alcohol was entirely withdrawn, and massage and electricity used.

Case 5. O., forty-two, a farmer, married, had been well until about October 1, 1907. He then noticed weakness of the fingers in milking. Both hands were affected, but the left slightly more than the right. There was no pain. He was also much troubled in walking, through weakness. The ends of the fingers seemed to be numb. Finally he was unable to lift objects or to use his hands for fine movements, such, for example, as currying a horse. There was no difficulty in micturition, no venereal history, no alcohol or tobacco. He slept well and had some headache. The bowels moved regularly.

The examination gave a good light and accommodative response with normal fields. Air conduction for watch tick was six inches on the right, about a foot on the left. He had had suppuration in both ears. Other cranial nerves were uninvolved. The heart was negative, the pulse 80, regular, with slightly hardened arteries. The muscles about the shoulder were normal and the movements free. There was also no evidence of muscular defect at the elbows or in the forearm. The skin of the hands was very coarse and thick, evidently from work and exposure. There was evidence of atrophy of the muscles of both hands. Extension was weak; flexion as shown by hand grasp was also weak; the ulnar movements were imperfectly performed. There was a tendency to flexor contraction of the fingers. The elbow reflexes were slight; the wrist reflexes not obtained. Sensation in the hands was preserved for temperature and for contact and presumably also for pain, although a prick seemed blunted, it was supposed on account of the roughness of the skin. There was no pain over the nerve trunks; the liver was of normal size; the abdomen showed no abnormality beyond the fact that there was no abdominal reflex. All movements of the legs were possible, and there was no visible atrophy. The knee jerks, Achilles and plantar reflexes were normal, and there was no clonus. Sensation of the feet, including sense of position, was unimpaired. There was no Romberg or ataxia either of the arms or legs, although he complained of a staggering gait, which he attributed to general weakness. He was unable to drive because the reins slipped through his fingers.

Diagnosis. The erroneous diagnosis of progressive muscular atrophy of the spinal type was made in this case from the insidious onset of the weakness involving primarily the small muscles of the hands without sensory disturbances. The blood and urine should have been examined to determine the presence of anemia, possible stippling of the blood corpuscles and the presence or absence of lead. These examinations were later made at the hands of another physician, who demonstrated anemia, no mention being made of stippling and lead in the urine. It is altogether probable, therefore, that the patient was suffering from Lead Poisoning which had led to a condition simulating progressive muscular atrophy. The differentiation between these two affections is important and often difficult, in certain cases (as in this) being definitely determined only by the actual finding of lead in the excretions. The existence of colicky pain is of more importance in arriving at a diagnosis than the lead line on the gums, which in well-kept teeth often does not appear. Lead affects peculiarly the motor portion of the mixed nerve, hence the absence of sensory disorders should not preclude the diagnosis of lead poisoning.

Prognosis. The outcome in this case is uncertain owing to the extent to which the muscular degeneration has progressed. The patient was seen and examined again about three years later. He was then almost entirely helpless, unable to walk or feed himself, but still without sensory disturbances. Under hospital care and mechanical treatment he again improved considerably and was able to use his arms and hands with some effectiveness. If the condition be due primarily to lead poisoning, as seems probable, it should be borne in mind that a progressive muscular atrophy may supervene on this basis. The ventral horn cells are almost certainly involved and a complete restoration of power is not to be expected.

Treatment. The patient improved at first under iodide of potash given in relatively small doses, five to fifteen grains. Mechanical treatment of the muscles in the later stages by means of Zander apparatus also resulted in marked improvement. Effective treatment of lead poisoning consists, first, in the elimination of the lead and, secondly, in the restoration of muscular power through mechanical means.

Case 6. L., thirty-eight years old, the mother of one child of fifteen years, had been married twice, the second time two years before. She had been a hard-working woman, but was neurotic in type and hysterical as a young girl. Previous to her second marriage she was apparently well. A year before she was seen, in May, 1907, she was greatly shocked by a shooting accident which occurred in her house. In August, 1906, her left elbow and left knee became painful and swollen but were relieved by the administration of salicylates, excepting that the left elbow remained stiff, with imperfect extension. More recently her jaw had swollen and been painful and she had had much headache. Her pulse, she thought, had always been slow. She had also noticed numbness and prickling, especially of the hands, feet and legs. For a week past she had not been able to work or, in fact, to stand. Her second marriage was supposed to be happy.

Examination showed widely dilated pupils with normal light and accommodation reactions and unconstricted visual fields. The face appeared rather expressionless, but there was no lesion of the facial or any other cranial nerves. There had been some complaint of soreness of the throat which an examination did not explain. For three or four weeks she had had definite nocturnal headaches, chiefly frontal and occipital. There was a sore spot apparently referable to the bone under the left breast. The heart was normal, the pulse 80, and regular. The arms were weak and painful on pressure over the large nerves. There was no apparent ataxia or objective disorder of sensibility in spite of much complaining on her part. The arm reflexes were not obtained. The abdominal reflex was present. There were no knee jerks, no Achilles response and slight plantar reaction. The legs were very weak, making walking impossible, and there was much pain on pressure over the nerves of the legs and thighs without at this time objective disorders of sensation. The bowels were costive, but there was no urinary disturbance. Axillary and inguinal glands were doubtfully palpable. Her mind was clear.

A second visit, twelve days after, showed the condition essentially unchanged, but worse rather than better. No

epigastric or abdominal reflex was obtainable, there was double foot-drop and considerable loss of sense of position in the feet and toes. In general, she was very weak.

Diagnosis. This case, although somewhat obscure and complicated by certain neurotic tendencies, was undoubtedly a Neuritis, presumably on the basis of a syphilitic infection, although the latter was never absolutely demonstrated. In such a case, the more recently discovered Wassermann reaction is of the greatest service in establishing the etiological factor and in determining subsequent treatment. The weakness, loss of reflexes, pain on pressure over nerve trunks, with intact sphincters, is enough to establish a definite diagnosis of peripheral neuritis.

Prognosis. Ultimate but very gradual recovery. The patient is now well and leading an active life.

Treatment. Iodide of potash and mercury were advised, but were at first not well borne. By persevering, however, she was finally able to take a large amount of both drugs. In such cases iodide of potash should be given up to 150–200 grains daily, and mercury, preferably by inunction, to the point of toleration.

Case 7. O., an unmarried woman of forty-five, gave a history of rheumatism. Her present trouble dated back about a month. She had been working hard, both mentally and physically, and had noticed a lack of power of flexion of the left hand and fingers, with pain about the inner condyle of the left elbow, down the ulnar side of the forearm and on the flexor surface of the left wrist on motion of the fingers or wrist. When at rest there was no pain. There was apparent "tendon grating" on flexion and extension of the carpus. The temperature had been somewhat elevated. The pain was not sufficient to prevent sleep, but was a source of considerable annoyance and incapacity.

Examination showed the whole left arm and hand to be weak and painful. There was distinct pain on pressure, especially over the median and musculospiral nerves in the upper arm. The brachial plexus was apparently not sensitive to pressure. Various movements of the hand were weak, the skin was puffy, sensation was blunted to pain and to hot and cold. There was evidence also of a tenosynovitis. Electrical examination gave a marked quantitative diminution to faradism, especially in the small thumb muscles, which showed the greatest degree of weakness. There was also a marked quantitative diminution to the galvanic current, but the contraction from the negative pole was greater than that from the positive. It was, however, slow in character. At the end of six months the patient had not entirely recovered.

Diagnosis. The diagnosis in this case was Neuritis involving nerves derived from the brachial plexus. The characteristic symptoms and signs of a neuritis were present,— pain on movement, pain on pressure over the nerve, objective disturbance of sensation, motor weakness, altered electrical reactions, in this case constituting a partial R. D. (see p. 15). There is no possibility of confusing such a case with a central lesion since motion and sensation were both involved and there was distinct pain on pressure over the nerve. The differential diagnosis from syringomyelia (see Case 51) is determined essentially by the lack of dissociation of sensation and by the presence of pain on pressure.

Prognosis. The outcome is good since there is no evidence

of a persistent cause, e. g., axillary pressure through tumor or aneurism.

Treatment. Expectant. (See also general treatment, p. 61.)

Case 8. G., a student of twenty, was seen June 1, 1910. Following pneumonia with pleurisy he developed a sore shoulder and weak arm and hand on the right. He had pain from the first but it did not extend down the arm. As he recovered from the pneumonia the hand and arm remained weak and this condition has not improved.

Examination showed pain on deep pressure in the axilla, but not to any degree over the nerves of the upper or lower arm. The right arm in general was about half an inch less in circumference than the left at various points. There was no shoulder-joint involvement nor manifest disturbance of the upper arm. There was no objective disorder of sensation, but a distinct subjective sense of numbness in the ulnar distribution. The arm reflexes were retained. Atrophy was marked in the hand, both of the interossei and thenar muscles. Extension of the hand was possible, but the grasp was very weak, as were the ulnar movements (ab- and adduction of the fingers; extension of the terminal phalanges). The little finger and thumb could not be approximated. Electrical examination showed a slow galvanic response, AnC=CaC, with reduced faradic reaction; partial R. D.

Diagnosis. This case is presumably a Brachial Neuritis following an infectious process. It differs from Case 7 in that the brachial plexus is itself sensitive to pressure and the motor disturbances are much more conspicuous in the hand than the sensory. The extreme atrophy of the small muscles of the hand is suggestive of a progressive muscular atrophy of the spinal type, particularly since the objective disturbance of sensation in the hand is exceedingly slight. The electrical reactions are consistent with either condition. On the other hand, the tenderness over the brachial plexus, the fact that pain has been somewhat conspicuous in the history and the wholly unilateral character of the affection all point strongly to the probability of a neuritis of a degenerative type.

Prognosis. If the supposition of a localized neuritis be correct, complete recovery is to be expected.

Treatment. In this case it is more important to treat the patient's general condition than the local disturbance. Pains should be taken to prevent the possibility of finger contractures.

Case 9. I., twenty-six years old, married, was well during her first pregnancy. The labor was difficult and the baby was stillborn. She made a good recovery with a slight temperature for a few days. Immediately after recovering from ether, taken during the delivery of the child, she complained of numbness at the front and side of the right thigh and later of pain under the knee and extending to the foot, with numbness of the foot. It became difficult for her to extend her leg, and about three days later, when examined, the right leg was still weak, there was much complaint of pain on movement of the leg, the calf muscles were flabby and movements of the foot were markedly hindered. There was diminished pain sense in the foot and loss of sense of position of the toes. There was also pain in the anterior portion of the thigh in the region supplied by the anterior crural nerve. There was definite pain on deep pressure over the nerves on the back of the leg and in the popliteal space. The patient was, in general, neurotic, and there was some slight hemianesthesia.

Diagnosis. The disturbance in this case was essentially in the distribution of the right sciatic nerve although the anterior crural distribution was slightly involved. Pain on pressure and on movement, together with objective loss of sensation in the terminal branches of the sciatic nerve, with considerable motor weakness, are characteristic of so-called Sciatica. It is to be presumed that pressure in the pelvis during the delivery of the child was the direct cause of the sciatic involvement in this case. It is of interest that even in such cases of apparently local pressure, signs of mild inflammation appear at a long distance from the point of injury.

Prognosis and Treatment. Recovery under rest, strychnia, massage and electricity was slow, — six months to a year, — but ultimately complete.

Case 10. C., a man of sixty, had for some years complained of pain in the lower abdomen. He saw various physicians, but nothing was accomplished for its relief. This pain gradually improved spontaneously. In June, 1907, while using a new automobile under considerable nervous strain, he noticed pain in the left sciatic region, which had increased in spite of treatment; fixation of the sacro-iliac joint had not resulted in improvement; the pain was especially severe at night. The patient's father had died twelve years before, presumably of rectal cancer. It is probable that the patient's original abdominal pain was the result of suggestion rather than indicative of the disease which later developed.

Examination showed the spine to be somewhat rigid, especially in the lower part. Hyperextension of the left leg was less readily performed than of the right. There was pain behind the knee. The pupils were equal, normal in reaction and fields. The cranial nerves were free; tongue straight, moist and clean. The arms showed no abnormality. The pulse was 72, slightly irregular. The liver was of normal size, the abdomen soft, with no painful areas; no tumor could be felt on external palpation. The abdominal and cremaster reflexes were normal. The legs showed no atrophy and were of good strength. There was some blunting of sensation over the whole sciatic area of the left leg and definite pain on deep pressure over the nerve throughout its course. The knee jerks were normal and equal, with no clonus and with normal plantar and Achilles response. The movements of the foot were free and the sense of position good. He walked without limp; the spine was not tender; the sphincters were normal. The pain was dull in character, but at times exceedingly distressing. It did not, however, extend into the right leg at this time. Later rectal examination disclosed a tender area over the sacrum which finally was definitely diagnosticated as a sarcomatous growth, inoperable in character. The patient grew worse and died within a few months.

Diagnosis. In this case unilateral sciatic pain which for a time passed as an ordinary sciatica was due to a Tumor of the sacrum invading the sciatic nerve. The unusual feature

of the case is the fact of the long persistence of unilateral pain. Bilateral sciatic pain is always strongly suspicious of a lesion within the vertebral canal since there the nerves of the two sides lie in close proximity to each other. In this instance a definite diagnosis of the cause of the sciatica was not to be determined until a careful rectal examination had been made

Prognosis. The patient lived several months after the definite diagnosis was made.

Treatment. Operation was out of the question and the Coley serum proved unavailing. In such cases of definite fatal termination and accompanied by extreme pain, morphine should be freely used.

Case 11. A., a woman of forty-five, unmarried, first had pain over the right sciatic nerve, as she supposed from over-exertion. She was, however, unable to remember any special strain. The pain was at first severe and grew worse. It was entirely confined to the right leg. The removal of a uterine fibroid did not relieve the pain which was of varied character, at times sharp like a knife-cut, and appearing in different places with soreness to the touch. There was not much pain below the knee. In general she was well; her bowels were normal and the pain was evidently not dependent upon their condition.

Examination showed a perfectly healthy appearing woman without other abnormality than the disturbance in the leg. In the right leg there were painful points at the exit of the sciatic nerve from the pelvis, also in the popliteal space and in the thigh. There was less pain in the calf and foot and no objective disorder of sensation. Motor power was retained, but with some tendency to contracture of the posterior leg muscles. The knee jerks were normal and active. A definite plantar reflex was not obtained on the right.

Diagnosis. This case offers no adequate etiology for the Sciatica — a very common experience. It is doubtful whether the supposed muscular strain was sufficient to produce the condition. Such vague causes should always be regarded with extreme doubt. A candid acknowledgment of ignorance is a safer attitude to assume.

Prognosis. Doubtful as to complete recovery.

Treatment. Avoidance of strain, and the general measures laid down on page 61.

Case 12. L., thirty-one years old, an unmarried woman, of somewhat neurotic type, after considerable violent exercise, especially horseback riding, experienced severe pain over the sacrum particularly on the left side. The pain improved and except for some discomfort on sitting she was apparently well and gained in weight. For two weeks there had been tenderness in the coccygeal region; she was easily tired; walking was painful; there was some pain also in the left leg and a very tender point within the rectal sphincter. She had noticed an accession of pain after horseback riding.

On examination, tender areas were found over both sacro-iliac joints, but especially on the left side. There was a particularly tender area over the left buttock, slightly above the sacro-iliac joint. There was also pain on pressure over the sciatic nerve in the thigh, popliteal space, and at the ankle. These painful points were much more marked on the right than on the left. Objective sensation was normal and motion was unimpaired. Knee jerks were both active; the plantar and Achilles reflexes were normal. There was no ankle clonus. The pulse was 76, regular; pupils wide but with normal light reaction; the patient was nervous in appearance and manner.

Diagnosis. This case illustrates disturbance in the sciatic nerve of the nature of a Sciatica as a result of a wrench of the Sacro-iliac articulation. In sciatica of doubtful etiology this possibility should always be taken into consideration. The diagnosis is greatly assisted by pain referred to the lower back, as in this case, accompanied by certain limitation of movements of the spine.

Prognosis and Treatment. The prognosis is good if treatment by rest, avoidance of back strain and fixation of the joint be judiciously employed. If neglected the pain is likely to persist indefinitely.

Case 13. C., an unmarried woman of twenty-six, was violently thrown from a double runner while coasting. She had various slight contusions, but excepting for the injury about to be described was essentially unhurt. She does not know how she struck, but immediately noticed that the right arm was completely paralyzed to the shoulder. The pain was not excessive and when seen in May, 1903, three and a half months after the accident, she was suffering no discomfort beyond the total loss of the use of her arm. She had not improved in the slightest degree.

Examination showed complete motor paralysis of the muscles supplied by the right brachial plexus with associated atrophy and electrical alterations. The sensibility was completely lost to a point somewhat above the elbow. From there to the shoulder there was some slight recognition of pain stimulus, increasing upward. The neck and back were normal. On January 27, 1904, an x-ray showed atrophy of the bones of the right hand. She was then able to flex and supinate the right arm somewhat with the biceps. Abduction and inward rotation were also slightly possible. There was reaction of degeneration in the interosseous muscles of the right hand and in the supinator longus; CaC was, however, greater than AnC. In spite of the fact that she was able to use the biceps to some extent, no electrical reaction was obtained from that muscle. Under faithful treatment by massage and electricity there was practically no improvement. Operation was finally decided upon in the hope of restoring by nerve suture a part of the function of the severed nerves. On exposing the brachial plexus, May 31, 1904, the individual nerves were found so badly damaged that the anatomical landmarks were completely lost. Certain sutures were, however, attempted, with the ultimate result after many months of a certain slight restoration of function in the arm and hand.

In April, 1905, there was extreme atrophy of the pectorals, deltoid and of the muscles below the elbow. Electrical reactions were very much as before. The trapezius reacted well and the pectoralis major feebly. There was no sensation below the elbow. Two years later the condition had not

materially changed. There was, however, increased power in flexion of the biceps and the possibility of extension of the fingers, with some flexion both of the hand and fingers. Flexion of the biceps had improved. There was still no sensation below the elbow.

Diagnosis. The diagnosis of Brachial Injury or destruction of the plexus is not difficult. In this instance, the complete loss of power with the retention of slight sensation indicated a very destructive lesion which the operation later revealed. It is to be noted that the nerves given off above the plexus did not take part in the process. It occasionally happens that the nerve roots are torn at their exit from the spinal cord. The combination of sensory and motor defect with atrophy, electrical alterations and flaccidity following traumatism permits of no other diagnosis than injury to the nerves after their exit from the cord.

Prognosis. The outcome of severe brachial injuries such as this is not favorable. The degree of recovery naturally depends upon the amount of primary injury. Operation on the brachial plexus is difficult, but in skilled hands offers very considerable hope of partial restoration of function as shown in this case.

Treatment. The treatment of such injuries is through electricity, massage and later surgical intervention, particularly in those cases where improvement does not take place.

Case 14. A., fifteen years old, was a first child. Instruments were used at her delivery. It was noticed shortly after birth that the left arm was paralyzed, although it showed no sign of bruising. There was gradual improvement, and at the age of four or five she had some movements in the arm. She had had no pain, was in general perfectly well and had noticed no disorder of sensation in the affected arm. For several years up to the time when examined, she had made no improvement.

Examination showed distinct weakness of the deltoid, biceps, supinator longus and the outward rotators (teres minor and infraspinatus) of the left arm, with no disorder of sensibility. Deltoid movements were practically impossible, flexion of the arm was exceedingly weak and outward rotation very defective. She was unable to feed herself. Faradic irritability of the muscles was, however, preserved.

Diagnosis. This is a typical severe case of Obstetrical Paralysis of unusually long standing. The fact that the labor was difficult, necessitating force, and that the paralysis, involving muscles of one arm, was immediate, renders the diagnosis certain of injury of the brachial plexus at birth. The exact method of production of this injury is not definitely established. There is no statement as to the position of the child during birth, but it is probable that the brachial plexus was put on the stretch in such a way as to yield at its weakest point, which experience shows is so localized that the deltoid, biceps, brachialis anticus, supinator longus and outward rotators are commonly involved.

Prognosis. The outcome of obstetrical paralysis is usually favorable. It rarely happens that it continues into adult life as in this instance. It is probable that had systematic treatment been employed at an early age the condition would have been greatly ameliorated.

Treatment. Mechanical treatment even now is desirable, designed not only to maintain the nutrition of the affected muscles but also to overcome the tendency to a fixed position of the hand and arm. Inasmuch as the nerves are usually injured but not severed, recovery is apt to occur through natural processes assisted by massage and similar measures.

Case 15. S., a woman of sixty-one, was thrown violently to the ground in connection with a railway accident. She was unable at once to get up but was not unconscious. She felt frightened and was faint, but was without pain, and thought herself uninjured. Later, pain developed over the left breast, and as light separation of the third rib from the sternum was demonstrated by x-ray. She had fallen on her right arm and shortly after the accident noticed marked difficulty in its use. At first, she was unable to raise it, and although there was no sufficient external sign of injury the arm seemed helpless. There was a somewhat painful point at the musculo-spiral groove. After about two months, she was able to write by placing her arm on a table to gain support, but even then there was difficulty in control.

Examination showed normal pupils and normal reflexes. The rib had healed and in general she was well except for certain nervous disabilities and a decided loss of power in the right arm. Abduction of the arm at the shoulder was sharply limited on account of pain. Outward rotation was also impossible for the same reason. The pain was referred to the base of the deltoid. There was also a distinctly painful point on pressure anteriorly over the shoulder joint. Other arm movements were possible, though somewhat limited through anticipation of pain. The nerves of the arm were not sensitive on pressure and there was no objective sensory disturbance.

Diagnosis. This case had been referred with the probable diagnosis of a brachial neuritis. The difficulty evidently is Sub-deltoid Bursitis as shown by the cardinal signs of pain on abduction and outward rotation with essentially unimpaired capacity for other movements, together with a painful point over the joint and pain referred chiefly to the base of the deltoid on forced movements of the arm. The absence of objective sensory disorder and the peculiar limitation of the disturbance precludes the possibility of a brachial neuritis. The differential diagnosis from the latter condition is extremely important.

Prognosis and Treatment. The prognosis of this type of bursitis is favorable. Recovery may occur spontaneously

after manipulation either with or without primarily breaking up the adhesions, or in more severe cases by operative interference, with extirpation of the bursa. Whatever treatment is undertaken it is essential that the adhesions between the surfaces of the bursa which cause the difficulty should not only be broken but should be prevented from reforming. This may be accomplished by forcible breaking of the adhesions with continued manipulation, by maintaining the arm in an abducted and outwardly rotated position through a specially devised splint, or by removal of the bursa itself. It is possible, also, that the bursa may be obliterated through general adhesion of its surfaces, resulting in ultimate cure through an entirely natural process.

Case 16. E., twenty-nine years old, married, a locomotive fireman, gave the following story. On July 27, he fell from the locomotive, striking his arm slightly below the right axilla on a steel projection in such a way that a cut was occasioned, requiring several stitches for its repair. In sewing up the wound no investigation was made of the condition of the nerves beneath. From the time of the accident he had had a complete wrist-drop with a considerable disorder of sensation in the radial distribution over the hand. There was no involvement either of the ulna or median movements. Inasmuch as sensation in the area supplied by the musculospiral nerve improved rapidly, it was believed that the nerve trunk had not been severed. Mechanical treatment by massage and electricity was continued with great faithfulness until December 22, a period of nearly five months. During that period sensation improved practically to the point of complete cure, but the wrist-drop persisted essentially without improvement. Operation was, therefore, advised.

December 22, an incision five inches long was made over the seat of the scar which was not adherent to the underlying tissues and showed a perfectly normal healing. A dissection was made exposing the musculospiral nerve as it passed into the groove. It was then found on raising the nerve from the groove that it was irregular in outline and converted at one point into a bulbous enlargement apparently involving the whole trunk of the nerve. There were no definite adhesions and the nerve was at no point divided. After scoring the bulbous enlargement longitudinally, the nerve was wrapped in cargile membrane and restored to its place.

Improvement began immediately, and twelve days after the operation he was able to extend the wrist somewhat, which had been entirely impossible before. This improvement continued, and when last examined, somewhat over a month after the operation, the hand could be extended to the horizontal position. Both before and after the operation there were marked electrical alterations both to faradism and galvanism. The reaction from the extensor muscles was slow.

Diagnosis. The interest of this case lies in the way in which the Musculospiral nerve was injured. Inasmuch as no adhesions were found, it is fair to presume that the damage to the nerve was produced by the violence of the blow crushing it against the underlying bone, the more superficial nerves being spared because of their position in the soft tissues. This type of injury should be considered in the case of those nerves which lie in immediate relation to bone. The result of the operation was entirely unexpected and remains difficult to explain except on the basis of improved nutrition and the overcoming of certain inhibitions produced by the swelling of the nerve as it lay in the musculospiral groove. The immediate improvement was unquestioned and it is altogether probable there will be a complete restoration of function.

Prognosis. The outcome of nerve injuries is in general favorable. It is evident in this case that the damage to the nerve was not extreme, and since improvement began immediately after the operation it is fair to assume that it will continue to complete recovery.

Treatment. As the event proved, surgical intervention in this case was delayed too long. No permanent harm was done by this conservatism, but improvement might undoubtedly have been hastened had the operation been undertaken earlier. It was delayed on the supposition that the nerve was not sufficiently damaged to preclude its recovery without operation.

NOTE. The following letter from the patient, recently received, shows the degree of recovery.

" I am very happy to say that my recovery is nearly complete and that I am sanguine that it will be absolutely so in a short while. My forearm is regaining its former shape and size, the wrist-drop has entirely disappeared, and my thumb and first finger are under almost complete control; the other three fingers are practically all right. I am able to make all the movements required by my work, and also those of eating, dressing, etc. I shaved to-day for the second time. There is only a slight weakness and lack of control

in performing a few things, such, for instance, as operating a typewriter or playing a piano. I am writing this letter with my affected hand. The sensation of touch is not quite normal on the back of my thumb yet."

Case 17. H., a man of sixty-four, a butcher by occupation, the father of twelve children, had been well up to three weeks before being seen. He woke one night with a feeling of "deadness" of the left hand. This condition had been gradually growing worse; he had had no sharp pain, but there was distinct weakness and difficulty in closing the hand. He drank beer occasionally, but very little whiskey, and had not been drinking in excess at that time. In general, he was physically well.

Examination showed the ulnar and musculospiral nerves intact. The median nerve was involved, as shown by the fact that the hand grasp was weak and imperfect, that the approximation of the little finger and thumb was not possible. There was, however, no visible atrophy nor objective disorder of sensation. Electrical examination gave no response to very strong faradic currents from the small muscles of the thumb. The galvanic current gave a slight contraction, slow in character, the AnC being greater than the CaC (complete R. D.). The flexors of the forearm were normal to both currents. Wrist jerks were not obtained on either side. The pupils and knee jerks were normal. The pulse was 88, and the heart not affected. Except for a low specific gravity, 1013, the urine presented no abnormality. About eight months later it was learned that recovery had been complete.

Diagnosis. Such an involvement of an individual nerve is not exceptional, although there is usually a more definite etiology than was obtained in this case. The blood pressure was not taken, but it is possible that circulatory disturbances may account for such temporary paralyses in persons of the age of this patient. Alcohol was not a factor. Pressure paralysis, due indirectly to alcohol, almost invariably for mechanical reasons affects the musculospiral nerve. We are hardly justified in terming such a condition a neuritis since signs of an inflammation were conspicuously absent. It is noticeable also that motion was very much more affected than sensation, again a not unusual experience in slight paralyses. The complete recovery of the patient shows that the cause was a transient one and presumably not due to his constitutional condition. Inasmuch as the three chief

nerves of the lower arm, the median, ulnar and musculospiral, supply in a general way respectively the flexors of the fingers, the interossei and most of the small muscles of the hand and the extensors of the wrist and hand, simple tests may quickly be made as follows: If the hand grasp be deficient in strength the median is involved; if abduction and adduction of the fingers with extension of the terminal phalanges be lost the ulnar is involved; if hyperextension of the hand is lost, giving rise to the striking condition of wrist-drop, the musculospiral is involved.

Prognosis. Recovery was rapid and complete.

Treatment. Guarding against over-use, rest of the muscles involved and faith in natural processes of repair was sufficient by way of treatment.

Case 18. I., a man of twenty-two, had an attack of typhoid fever in the summer of 1907. He was very ill at a hospital for ten weeks. Shortly after entering the hospital, he noticed numbness of the two inner fingers of the left hand. Three weeks later the muscles between the thumb and first finger on that side showed particular atrophy although both hands were very thin. When he recovered from the fever there was persistence of numbness of the two outer fingers of the left hand which had extended down as far as the wrist. It was most marked in the little finger. The rest of the hand appeared to him normal, as did the right hand. The patient thought that possibly repeated hypodermic injections in the deltoid region of the left arm might have been the cause.

Examination showed normal cranial nerves; the urine had a specific gravity of 1,022 with no albumin; the heart and pulse were normal, as were the reflexes. In general there was no discoverable disorder excepting in the left ulnar nerve. Special examination of this nerve showed that it was not painful to pressure at any point. All the muscles of the hand supplied by it, namely, all excepting the outer short muscles of the thumb and two lumbricales, were markedly wasted. Movements were very weakly possible. Contact was not so well felt on the affected fingers as elsewhere. The temperature sense was not altered and there was some evidence of hypersensitiveness to pain stimuli. The electrical examination showed very slight faradic response of the affected muscles. Galvanic stimulation gave in places a slow reaction with the AnC equal to the CaC. The reaction of degeneration was, therefore, not wholly complete.

Diagnosis. The distribution of the paralysis, both of sensation and motion, sharply confined to the ulnar distribution justifies the diagnosis of a local Degenerative Neuritis of that nerve, presumably associated with the attack of typhoid fever during which it began. Generalized post-typhoidal neuritis is not unusual. It is, however, exceptional that a single nerve should be thus involved.

Prognosis. The course of the difficulty is inevitably slow when so high a degree of degeneration of the nerve exists. The ultimate outcome is, however, favorable.

Treatment. The hand should be spared as much as possible, particularly in relation to those movements which demand a special use of the muscles supplied by the ulnar nerve. In this case also it is essential that the general nutrition be restored as rapidly as possible. The usual local treatment by massage, electricity and bathing is advisable in such a condition.

Case 19. S., a man of twenty-four, while driving an automobile, through skidding of the car, struck a tree, was overturned and pinned under the car in such a way that great pressure was exerted over his thighs. He did not lose consciousness for any length of time and noticed at first severe pain followed by a sense of numbness of the right leg. When rescued at the end of an hour he was unable to move.

Examination, however, showed that there was no definite injury beyond a pressure bruise over the peroneal nerve on the right side below and to the outer side of the knee. Foot-drop was complete. The thigh was unaffected, as was the left leg. A strip of anesthesia extended from the outer side of the knee downward and forward over the leg to the great toe. The knee jerks were present; there was no Babinski; the plantars were both normal when examined about six days after the accident. There was no evidence that the nerve was cut, but improvement under massage and electricity has been exceedingly slow, so that at the end of about two months foot-drop persists. An electrical examination bore out the supposition of injury to the peroneal nerve.

Diagnosis. Foot-drop is due to weakness of the anterior group of muscles of the leg, commonly known as the Peroneal group. These muscles are the tibialis anticus, the peronei, extensor longus digitorum and extensor proprius hallucis. Owing to the very much greater strength of the posterior muscles of the leg, secondary contractures are liable to occur. This should be guarded against in the treatment of foot-drop, by supporting the foot in a semi- or hyper-extended position by means of a splint at least part of the time.

Prognosis. Recovery from such conditions is slow, usually a matter of many months.

Treatment. It is primarily important to prevent stretching of the weakened muscles. Massage and electricity are desirable, and were used in this case, to assist the natural process of repair. Violent manipulation, with tiring of the already weakened muscles, must be avoided.

Case 20. T., an unmarried woman of thirty-nine, occupied with office work, about the middle of December, 1909, suffered a paralysis of the right side of her face. She had had rheumatism, had worked hard, but in general was well. For several days preceding the paralysis she had had pain in and in front of the right ear. There was no swelling of the drumhead and no temperature. During twenty-four hours the paralysis grew rapidly worse, and at the end of that time attained its maximum. There was no history of undue exposure, and no definite pain beyond that in and about the ear. When seen, January 5, 1910, hearing was normal in both ears. There was complete palsy of the right side of the face, all branches of the seventh nerve being involved. Taste was slightly affected on the paralyzed side of the tongue. There was very slight faradic response to the muscles. The galvanic response gave active but slow response from both poles, which were about equal. The reactions on the affected side, both to the anode and cathode, were greater than on the normal side. Indirect stimulation through the nerve gave a possible very slight response from the muscles. The reaction of degeneration was, therefore, partial. In other respects the patient showed no abnormality. Her improvement was uninterrupted.

Diagnosis. This is a typical case of so-called Bell's palsy, involving the whole right facial nerve. Inasmuch as there was some disturbance of taste, the lesion is to be located between the geniculate ganglion and the point at which the chorda tympani is given off from the facial nerve. The fact that all three branches of the nerve were equally involved places the disturbance in the peripheral nerve rather than in the central neurones connecting the cortex with the facial nucleus in the pons. Preliminary pain in the mastoid region or in and about the ear is a common precursor of facial paralysis, possibly due to the involvement of the pars intermedia in the process.

Prognosis. The prognosis in such cases is good, even if a complete reaction of degeneration develops. Recovery is slow, however, and may leave certain secondary defects of the nature of contractures and spasmodic movements.

The electrical reactions are the most valuable means of determining the outcome and the rapidity of recovery.

Treatment. Strychnia by the mouth or subcutaneously, gentle massage of the affected muscles, and electricity are the best means of treatment in such a case. If the muscles respond to faradism this variety of current should be used; if not, the galvanic current, with preference for that pole which gives the better reaction. Electricity should be discontinued when voluntary power returns, especially if associated with spasm.

Case 21. O., a man of forty-three, was thrown, in the summer of 1908, from an automobile, striking on his left shoulder, as the result of a collision. He was at first unconscious but was later able to walk. His left clavicle was fractured and he was at once deaf on the left side. There was bleeding from the ear that night and the following morning, whether or not mixed with cerebrospinal fluid is not known. He did not suffer much pain. The accident was on a Saturday. The following Thursday or Friday he first noticed "stiffness" of the muscles of the face. This came on gradually and had improved somewhat. He remained in bed for nine days without headache, but blowing his nose was painful. The ear ceased to discharge. There was a painful point at the articulation of the jaw.

Examination sixteen days after the accident gave the following conditions: The pupils were normal in light and accommodative reflexes and the visual fields were not restricted. Hearing was much diminished on the left, both by air and bone. A watch placed almost if not against the ear could be heard, but not at a greater distance. The left ear drum was ruptured. There was incomplete paralysis of the left facial nerve. The eye could be nearly closed; whistling and movements of the left side of the face were difficult. There was a quantitative diminution both to faradic and galvanic stimulation from nerve and muscles. The CaC was greater than the AnC and the response was quick. There was, therefore, no R. D. Taste was possibly slightly affected on the left side. Otherwise there were no cranial nerve involvements and the patient in general was in good condition.

When seen again, six and a half months later, the history given was that the improvement continued without interruption and that the paralysis of the face had given place to a twitching of the same muscles. The deformity of the face resulting from paralysis had subsided in about three months. His hearing, he thought, had also improved. This latter supposition was justified by an examination which showed fair air and bone conduction, in marked contrast to the condition at the first examination. Electrical examination

of the affected nerve showed normal reactions. There was also slight spasm in the facial muscles of the left side.

Diagnosis. This patient undoubtedly suffered a slight Basal Fracture extending, as is usual, through the temporal bone in such a way as to involve the internal and middle ear. The rupture of the ear drum is a natural consequence of a violent blow on the side of the head. Consequent upon the original injury the left Facial nerve was damaged, presumably by hemorrhage in its course through the middle ear. Facial paralysis, often of a severe type, is a common result of fracture of the base.

Prognosis. The function of the facial nerve was in this case entirely restored within four months. The extent of improvement naturally depends upon the degree of primary injury. The tendency is always toward recovery.

Treatment. No treatment was necessary in this case. When the conditions within the ear were adjusted through the absorption of exudate and hemorrhage, the nerve regained its function. There is no available treatment for the secondary spasm, often an exceedingly troublesome outcome of facial paralysis. In this case, the spasm was so slight in degree that it is not likely to give rise to any considerable annoyance in the future.

Case 22. R., a teacher of twenty-nine, except for the fatigue incident to her work, had been well up to July, 1906. At that time she suffered from general pain and sense of soreness, but had no definite rheumatic attack. She was also worried about her sister, who was at a hospital. Her sleep was poor, she was tired at night, had pain in the back and neck; at times her whole back felt tender, but in spite of her discomforts she continued her teaching. Two weeks before being seen she noticed in the evening, after a hard day, that her face was suddenly drawn to one side. She had no pain in connection with this paralysis. Several days before, she had been particularly exposed to cold, but she was not conscious of any exposure immediately before the paralysis came on. The morning following, the paralysis was complete, and with it there was considerable pain in the distribution of the right facial nerve, together with the previous pain at the back of the head and neck. There was no history of ear suppuration and she had not observed any disorder of taste.

Examination showed a practically complete right facial paralysis. She was unable to close her eye and the lower muscles were also beyond her control. There was no pain on pressure over the facial nerve, but the face had a swollen appearance and, as stated above, there had been much complaint of pain at night, which had interfered with her sleep. On the anterior two thirds of the tongue of the affected side sweet and salt could not be distinguished, whereas they were easily recognized on the normal side. Electrical examination showed a partial R. D. There was slight faradic response from the affected nerve and muscles; a slow galvanic response, with the positive pole equal or predominating over the negative pole. The hearing was normal and there was no ear suppuration. In other respects the patient showed no significant abnormality.

Diagnosis. This is an instance of Facial Paralysis of the so-called peripheral type in which the involvement of the nerve extends inward as far as or possibly including the geniculate ganglion. Taste in the anterior two thirds of the tongue is supplied presumably through the chorda tympani nerve, which runs with the facial nerve in its passage through

the middle ear, later leaving that nerve to pass with the lingual of the fifth to its destination in the tongue. The involvement of taste is practically valuable from a diagnostic standpoint in that it determines the location of the lesion between the geniculate ganglion and the exit of the nerve from the skull. A lesion of the facial nerve proximal to the geniculate ganglion does not involve taste fibers.

Prognosis. The prognosis in this case is entirely favorable.

Treatment. Inasmuch as reaction of degeneration was not completely established, treatment of the nerve by a faradic current was indicated. In view of the general debilitated condition of the patient a respite from work was desirable.

The **symptomatology** of affections mainly involving the peripheral nerves is sufficiently indicated in the cases given in detail above. The **etiology** of such affections is particularly important to determine because of their almost uniformly good prognosis if the exciting cause can be removed. Injuries to nerves and new growths (neurofibromata) or other tumors in the immediate neighborhood of nerve trunks are usually easy of determination. Slowly acting poisons, such as alcohol, lead or arsenic, may usually be recognized if their great importance in the production of generalized neuritis be borne in mind. The simulation of cord or cerebral lesions is, however, often so close that errors may readily be made, as, for example, the misinterpretation of a psychosis due to lead, or the simulation of tabes by an alcoholic neuritis (see Case 2). Infections of various sorts are frequently the precursors of peripheral affections, as, for example, neuritis following typhoid or diphtheria, or in association with poliomyelitis. In many cases, however, no definite etiology is obtainable, and the assumption must be made that neuritis, often of a degenerative type, occurs in cachexias of various sorts, e. g., in tuberculosis, cancer or less definite conditions. In general, it may be said that the peripheral nerves are extremely prone to disease, but also show a very marked capacity for recovery. **Treatment,** therefore, apart from surgical interference, — suturing and repair of injury in

general,— consists very largely in assisting a natural tendency to recovery. Such assistance may be given in the first place by removal of the cause, — alcohol, lead or a generally depraved physical condition; in the second place, to slight degree by drugs, notably strychnia, and effectually by iodide and mercury, when syphilis is a factor; and in the third place by mechanical measures, in which massage, electricity, hydrotherapy and carefully regulated exercises play the most important part. Massage helps by maintaining circulation, assisting atrophied muscles and overcoming a tendency to contractures with resulting deformities. Electricity is of far less service, but serves to stimulate muscles no longer under control of the will and thereby in some measure at least to preserve and restore normal function. Hydrotherapy is useful as a general tonic measure, and exercises designed to restore normal muscular tone are of distinct value. None of these measures should be applied during the active inflammatory stage, except with the greatest caution and reserve.

SECTION II.

SPINAL CORD.

THE cord is essentially a concentrated conducting mechanism between the widespread nerve distribution of the periphery and the brain. On the motor side neurones originate in its ventral horns, the axones of which pass outward to the muscles; on the sensory side the cell bodies constitute the dorsal ganglia from which axones pass into the cord and to the periphery. The course of the main sensory fibers within the cord is shown by the accompanying diagram. It will be seen that the fibers subserving pain and temperature cross soon after entering the cord, whereas those subserving contact and joint sensibility presumably in great part pass upward in the dorsal columns uncrossed as far as the oblongata. All the sensory tracts ultimately reach the parietal region of the brain by way of the fillet and the thalami. The motor tracts are constituted by two neurones: One from the pre-Rolandic cortex through the anterior portion of the posterior limb of the capsule, thence through the pes pedunculi, pons and largely crossing in the oblongata to constitute the pyramidal tracts of the cord, thus becoming associated with the primary

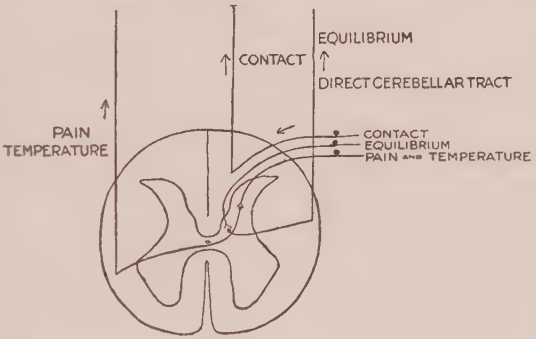


FIG. 9.

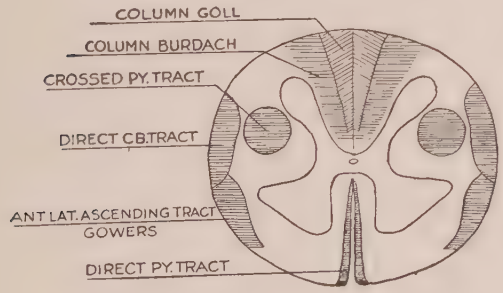


FIG. 10.

motor neurones from the ventral horns to the muscles (see Fig. 2). In a cross section of the cord these various tracts appear as shown in Fig. 10.

In studying affections of the cord it is essential to bear in mind that the dorsal columns are sensory, the lateral pyramidal tracts motor, and the ventral horns motor, with trophic relations to the muscles (see earlier discussion, p. 18).

A peculiarity of a group of spinal cord diseases is their systemic character, by which is meant that certain neurone tracts show a distinct tendency to individual degeneration. Examples are tabes, amyotrophic lateral sclerosis and simple spinal progressive muscular atrophy. A less-marked tendency to such systemic degeneration is shown in the combined neurone diseases of the ataxic paraplegic type. Still other affections show no tendency whatever to such tract limitations, as, for example, multiple sclerosis, myelitis. From a pathological standpoint lesions of the cord are inflammatory, — myelitis, poliomyelitis; degenerative, — tabes, progressive muscular atrophy; proliferative, — gliosis, syringomyelia; destructive, — new growth, pressure from without, Pott's disease; or the result of trauma, crush and softening from external violence. Examples of these varied conditions are given in the following cases:

Case 23. I., six years old, was well up to July 22, 1909. He had been riding a bicycle vigorously and had had a fall ten days before, striking his head, but leaving no after-effects. There was no definite indiscretion in diet. He had never been very well nourished. Some months before he had suffered from nasal catarrh and had had his tonsils removed. On July 27, he had fever and vomited. On July 28, the temperature was 101.4° in the axilla; the pulse, 140. He continued to vomit, but otherwise did not appear ill. The following day there was some muscular twitching and slight discomfort in swallowing. The temperature persisted but did not go above 102° in the axilla. On August 1, the temperature became subnormal. The following day there was complete paralysis of both legs, but none of the arms. There

was some pain in the back, no rigidity of the neck muscles and no stupor. At the onset of the illness he was slightly delirious but not subsequently.

Examination showed normal pupils; no involvement of the cranial nerves; the tongue slightly coated. The right arm was entirely normal; there was some pain on deep pressure over the nerves of the left arm, also on raising the arm over the head. The left leg was completely paralyzed; on the right there were merely slight movements of the toes. The knee jerks were absent and no plantar reflexes were obtained. Sensation was unaffected except for pain on pressure over the nerve trunks, especially in the popliteal spaces and in the calves. Complete forcible extension of the legs was difficult on account of the pain. The heart showed no abnormality and the urine was normal. A later examination showed very marked improvement but persistent weakness of the back muscles, the muscles of the thighs and the anterior leg muscles. It was possible for him to balance himself with support. Improvement with orthopedic appliances, massage and exercises has continued up to this time, March, 1911. He is now able to walk to a certain extent with apparatus.

Diagnosis. The history of this case is typically that of Acute Anterior Poliomyelitis. An unexplained rise of temperature for several days together with gastro-intestinal disorder followed by flaccid paralysis of one or all extremities, is always strongly indicative of poliomyelitis. If this paralysis is followed by atrophy with altered electrical reactions, but still with a tendency toward recovery, the diagnosis is still further substantiated. In the foregoing case these conditions were all present and there is no possibility of mistaking the signs for any other disorder of the central nervous system.

Prognosis. The prognosis in this case is perfectly good as regards life. The patient was at no time in the slightest danger. As regards usefulness of the limbs, the prospects are for partial recovery, with, however, a considerab e permanent disability.

Treatment. After the first week or ten days, the treatment was massage, passive and, so far as possible, active

movements of the affected limbs; later, when the prospect of the recovery of muscles grew less, the application of supportive orthopedic appliances for the back and fixation of the joints.

Case 24. E., twenty-four years old, in the latter part of August, 1906, was attacked by diarrhea and bowel pain, with loss of energy and disturbed sleep, but at first without headache. He improved and at the end of three days returned to his work, but was again obliged to desist because of sudden onset of back pain, with retraction of the head. There was still no headache, although his head continued to be drawn back. Six days after the onset of the illness he went to a hospital, and was at once put to bed. He was stuporous for two or three days and had a temperature which did not go above 101°. Examination on entrance showed a moderate degree of prostration, a flushed face, rigid neck with slight retraction of the head, active knee jerks and skin reflexes, with a Kernig sign on the left. After admission, when the temperature had fallen to normal, paralysis of the right arm and leg developed, with slight involvement of the right face. There was also diplopia, and double Kernig sign was noted. Five days later the neck was less stiff, he was conscious and rational and complained of pain in the back and legs. At the end of eight days, he was able to move the right arm slightly, and the neck spasm was decidedly less. Dark red pin-point spots, some hemorrhagic in character, developed over the abdomen, chest and arms. Tenderness over the nerves of the right side subsided in about thirty days and sensation was not otherwise affected. Improvement in the paralysis was steady, the arm gaining strength at first more rapidly than the leg. The urine was normal and micturition unaffected, except on the first day. The white count was 16,000; the Widal reaction, negative.

A diagnosis of *meningitis* was made at the hospital, and was not changed at the time of his discharge, forty days after entrance.

When seen a year or more after, there was general atrophy of the right shoulder-girdle muscles, upper arm, forearm and hand. The right leg was similarly atrophied; he was unable to extend the toes. Elbow and wrist reflexes were well marked on the left and lacking on the right. The abdominal, epigastric and cremaster reflexes were present and equal on each side. The knee jerk and Achilles reflex were

not obtained on the right, and the plantar reflex was less marked than on the left. Sensation, including musculer sensibility, was everywhere normal and there was no tenderness over nerve trunks. The cranial nerves showed no abnormality. Remarkable improvement followed treatment in this case.

Diagnosis. The foregoing case is an excellent example of the Meningeal Type of Poliomyelitis. So conspicuous were the meningeal symptoms during his residence at the hospital that the error in diagnosis was not corrected even after an observation extending over forty days. Had a lumbar puncture been made, this error could hardly have occurred, since, particularly in a meningitis involving the cord, evidence of the inflammation would doubtless have appeared in the cerebrospinal fluid. The rigid neck, transient stupor, and Kernig sign are not enough to establish a diagnosis of meningitis. These signs are all of frequent occurrence in poliomyelitis, but the development of an extensive, flaccid paralysis should have rendered the diagnosis practically certain. It is not to be doubted that many such csaes in the past have been erroneously diagnosticated as primary meningitis. A further fact worthy of mention in this case is that, after apparent recovery and return to work, symptoms again developed, leading on the sixth day to paralysis of the unusual hemiplegic type.

Prognosis. The outcome in this case has been a practical restoration of function. In general the prognosis of the " meningeal " and " peripheral " types is better than of the spinal type.

Treatment. Mechanical methods of treatment undoubtedly assisted greatly in bringing about the favorable result.

Case 25. S., a girl of twelve, previously well, as it was supposed "caught cold." The following morning her throat was painful and there was pain in the muscles of the neck. Diphtheria and, later, typhoid fever were considered, and tonsillitis was diagnosticated. She was in bed for about two weeks with fever as high as 103.5°. The neck was swollen, particularly on the right side. She complained also of pain in one of her legs. About two weeks after the onset, on attempting to go down stairs, she found that she was practically unable to walk on account of leg weakness. She had then also an internal strabismus. She recovered from the fever and at no time complained of headache or other pain excepting in the neck, which felt stiff. She vomited somewhat during the preliminary illness. The weakness in the legs presumably came on while she was ill in bed and the exact time of its onset cannot, therefore, be determined. The pain in the neck passed off in about a week. She also had pain in both thighs, then in the legs. The arms remained normal. Diplopia was observed at the end of about a week.

She recovered so far as her general condition was concerned, but with the following defects evident on examination, four months after the acute attack. Smell was unimpaired, the eye grounds were normal, there was paresis of the left external rectus, with diplopia on looking directly forward and toward the left. The position of the two images was not parallel. The facial nerves were not involved, although there was a possible slight asymmetry of the face. In chewing, food collected in the cheeks but about equally on the two sides, apparently due to involvement of the fifth rather than the seventh nerves. The mouth was opened imperfectly with a maximum aperture between the teeth of five eighths of an inch, and the lower jaw sagged toward the left. Lateral movements were also imperfect, the jaw moving considerably better toward the right than toward the left. There was general weakness of the muscles supplied by the fifth nerve, probably on both sides. The hearing was normal; the tongue was protruded markedly toward the left, and was soft and atrophied on the left side. The uvula sagged somewhat to the right and was flaccid. Taste on the anterior two-

thirds of the tongue was unaffected on either side. There was a distinctly nasal voice, but with no aphonia. Difficulty in swallowing was marked. The arms were normal; the heart negative with a pulse of 120; the legs were weak, the left much more so than the right. It was difficult to rise from a chair; the gait was unsteady, with a strong tendency to fall. The left foot was turned outward and pronated, and the muscles were weak. The knee jerks were more active on the right than on the left. There was no Babinski; the Achilles jerks were present, and sensation was unimpaired. Seen again about three weeks later there was general improvement in walking, in the capacity to open the mouth, in speech and in the paresis of the uvula. She still had diplopia and very marked atrophy of the tongue, with difficulty in swallowing. This improvement continued, but when last seen the defects mentioned above were still persistent, although not so troublesome, in part because she had become more accustomed to their presence.

Diagnosis. This case escaped diagnosis at the hands of her physician, because of its resemblance to meningitis or to typhoid fever. The subsequent course of the disease with persistence of definite muscular weakness shows it undoubtedly to have been Poliomyelitis or, more strictly speaking, a Poliencephalomyelitis involving various cranial nerves as well as the legs. The points of special interest in this as in other cases of poliomyelitis are: The insidious onset of the disease and the difficulty at the outset of making an exact diagnosis; the predominant involvement of cranial nerves; and especially the unilateral atrophy of the tongue from an invasion of one hypoglossal nucleus; the fact that these cranial nerve disturbances, although marked on examination, were practically unrecognized by the patient; and finally, the great rarity of so extensive an involvement of cranial nerves extending well into the pons as shown by the paresis of the fifth and sixth pairs. The meningeal symptoms with stiffness of the neck constitute, according to recent experience, a common group of signs in the early stages of the disease.

Prognosis. The outcome has been favorable. There is a

possible persistent danger in the paresis of the throat muscles, but this is slight.

Treatment. There is no available treatment for the cranial nerve involvements. Greater care should be observed in masticating and swallowing than under ordinary circumstances, and such exercises as are possible should be practiced to overcome the motor defects of the nerves involved. The condition of the leg improved under treatment and when the patient was last seen was a source of trifling inconvenience.

Case 26. N., twenty years old, a student of unusually strong physique and hitherto well, had been employed in out-of-door work during the early part of the summer of 1910. He had been in the habit of swimming in fresh water five or six times a week. June 25, he had what he called a "bilious attack," which was relieved by castor oil. He recovered and returned to work. August 2, he had chilly sensations, and in general did not feel well. He went to work, however, the next day as usual but was conscious of some stiffness of the neck with headache. The following day, August 4, he remained at home and in bed. His temperature was slightly over 100°. He was able to get up and there was no paralysis. The stiff neck persisted and that night he was unusually restless. The next morning, August 5, weakness of both arms appeared, much more marked on the right. The legs were unaffected. During the day the paralysis increased; some difficulty in speech developed, associated with an extreme degree of apprehensiveness. In general his mental state seemed not wholly normal. When seen at nine on the evening of August 5, examination showed the following conditions:

The pupils were wide and responded well to light. There was no definite paralysis of the seventh pair, but whistling was not easily possible. The masseters were strong, the tongue well protruded, straight and freely movable. There was no aphonia but speech was difficult, evidently owing to want of air. Respiration was very superficial; no breath sounds were heard over the right apex. He yawned continually, complained that the room was close, and there was every evidence that he was suffering from respiratory difficulty. There was no movement whatever of the accessory muscles of respiration; the diaphragm alone was active. Excepting for slight movements of the hand, the right arm was paralyzed. The arm reflexes were lacking; there was no pain over the nerve trunks. The left arm was also extremely weak. The neck was stiff; the head could be moved laterally, but with difficulty directly forward and backward, and swallowing was difficult. There was no abdominal reflex. The legs showed no manifest involvement; the knee jerks were inactive;

there was no clonus or Babinski sign; slight normal plantar flexion and well-marked Achilles reflexes. The increase of respiratory symptoms was rapid, and death occurred at 3 A.M. from respiratory failure, less than twenty-four hours after the onset of paralytic signs. The heart remained fairly normal in action until near the end, with a pulse of 100 to 120. There was much restlessness during the last hours, with delirium of a distressing sort, — that he was being choked, that there was a band about his neck, — evidently directly dependent upon the air hunger.

Diagnosis. This case is a typical example of the rapidly fatal form of Poliomyelitis, and should not easily be mistaken for any other condition. The mode of onset, followed by a flaccid atrophic paralysis, is perfectly characteristic.

Prognosis. In this, as in practically all cases of death from the disease, the fatal outcome was due to an invasion of the upper portion of the cord, involving the phrenic nerve (third and fourth cervical segments) and the nerve supply of the accessory muscles of respiration. The prognosis as regards life is determined by the location of the pathological process rather than by its essential severity.

Treatment. In such a case there is nothing to be done beyond rendering the final hours as peaceful as possible. Artificial respiration is certainly not desirable in a condition of so hopeless a character, associated with the most acute physical and mental suffering.

Case 27. E., a married man of twenty-seven, of previous good health, active in business, in general of good habits, and without venereal infection, was seized on September 15, 1907, with pain in the lower back. This he had noticed slightly two days before. When seen by his physician on the day following the severe pain his temperature was slightly elevated. The diagnosis of probable lumbago was made. The next day, September 17, he still complained of pain in the back which extended into the sciatic nerves. He felt weak and tired and generally nervous from loss of sleep and pain. On the morning of the 21st, however, he was able to walk, but later the same day suddenly lost power in the right leg and had increased pain in the left leg. The night following, the left leg was also paralyzed similarly to the right and he was unable to pass urine voluntarily. On September 22, there was paralysis of both legs and of the bladder and rectum, necessitating catheterization. The temperature was 104°.

When seen on the afternoon of September 22, the patient appeared very ill. There was sordes of the lips; the skin was hot and dry; the tongue coated. The pupils were equal in size, with adequate light and accommodative response. There were no paralyses of the cranial nerves. His mind was perfectly clear, but he was extremely apprehensive in appearance and manner; tremulous, but not emotional. The heart, liver and spleen were normal; the pulse somewhat rapid. There were no paralyses of the arms, and sensation of the upper extremities was normal. The breathing was slightly labored, but the movements of the chest were in general good. There was no disorder of sensation over the body nor painful points over the spine. The abdominal reflexes were very slight. The legs showed much motor weakness and could not be raised from a horizontal position. No movements of the right foot were possible, but definite though slight contractions of the muscles both of the thigh and leg could be made. The movements of the toes of the left foot were retained, also of the large muscles of the thigh and leg, which were somewhat stronger than on the right. The knee jerks were very slight on the left and not obtained

on the right. There was no plantar reflex. There was definite front tap contraction in both legs, but no Achilles response or clonus. Sensation to touch, pain and temperature was normal. Sense of position was also undisturbed.

During the following twenty-four hours the paralysis steadily ascended and the patient died at 3 A.M , September 24.

In connection with this case it is of interest that a child of the patient, three and one-half years old, had been well up to September 7. He then was taken with sudden rise of temperature and general feelings of illness. Supposing his condition to be due to a condition of the mouth, the gums were lanced and the temperature diminished. He was regarded as recovered, but it appeared, although the family had not particularly noticed this fact, that he had not walked since. Cursory examination showed partial paralysis of the left arm and of both legs. The father, as stated above, was taken ill one week later.

Diagnosis. The case of the father illustrates the virulent and quickly fatal form of Poliomyelitis of the ascending type, undoubtedly often mistaken in the past for so-called Landry's Paralysis. The association of this rapidly fatal case in an adult with that of a child of a far milder form in the same family is a matter of importance in connection with epidemiology. It should not, however, forthwith be assumed that one case was derived from the other, inasmuch as both may have been derived from a common source. The fact of actual contagion has not been satisfactorily established in this disease, but its possibility should be borne in mind pending further investigation. It should be regarded as definitely infectious and therefore potentially contagious.

Prognosis. The fatality of poliomyelitis depends upon the involvement of the nerves concerned in respiration. A localized invasion of the cervical cord or oblongata is, therefore, much more serious than a widely extended invasion of other portions of the nervous system.

Treatment. Treatment in this case was entirely unavailing.

NOTE. Poliomyelitis, or, as it should more properly be called, poliencephalomyelitis, is a general infection of the

nervous system due to a filterable virus of unknown character. The mode of dissemination of this virus is also wholly unknown beyond the fact that it seems probable that its point of entrance is the nasal mucous membrane. The primary effect is a generalized inflammation of the brain and spinal cord membranes associated with elevation of temperature and other signs of general infection. The frequent but not constant result of the infection is an invasion of the spinal cord and brain stem particularly, leading to destruction of the motor nerve cells with consequent atrophic paralysis, depending upon the extent of the destructive process.

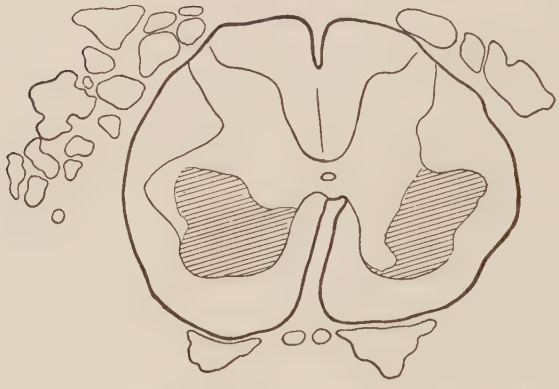


Fig. 11. Poliomyelitis; Partial Destruction of Ventral Horns.

The infectiousness of the disease has been amply demonstrated experimentally; its contagiousness is still in doubt; there is much evidence to show that the virus is widely prevalent at certain seasons and that it is not immediately transmitted from person to person. The outcome of the disease varies widely, as illustrated by the preceding cases. In the preparalytic stage and as a possible prophylactic, urotropin may be liberally used. It is certainly inefficacious after the paralysis has developed. The subsequent treatment depends upon the nature of the residual paralysis. In the natural process of recovery of muscular power, great care must be taken not to stretch paralyzed muscle groups. Much may be accomplished for an indefinite time, a year or more, by assiduous massage, exercises and muscle training, accompanied if necessary by surgical procedures. Apparatus should be applied late, after all possibility of muscular recovery has passed. Each case should be subjected to painstaking individual study.

Case 28. U., thirty-two years old, gave as his chief complaint that he was unable to use his left arm properly and that it had grown smaller. As a child, he had not had convulsions or children's diseases. At twenty, he had gonorrhea, followed by rheumatism in knees, ankles and wrists. Five and again two years ago he had had further attacks of joint infection, and at one time a transient hematuria. About one and a half years ago it was noticed that his left arm was thinner than the right, although at that time this occasioned no inconvenience. Later, the arm became noticeably weak, and for the past few months he had noticed progressive difficulty in raising the right arm as well as the left, which was primarily affected. He had also observed that the right arm was growing smaller as the left had been doing for upwards of a year past. For two or three weeks he had been annoyed with what he called "twitching pains," especially in the left arm and leg.

Examination showed a poorly nourished man with sallow skin, pupils slightly irregular but reacting properly to light and distance. There was no Romberg sign. Hearing was somewhat impaired, especially on the left. The throat showed nothing abnormal. There were palpable cervical, axillary, epitrochlear and inguinal glands. Over the chest many sharp fibrillary muscular contractions of the pectoral muscles were noticeable, together with similar contractions in the sternomastoid, biceps, triceps and other muscles of the upper extremities. The back showed a lateral curvature of the spine, toward the left in the thoracic region and to the right in the lumbar region. There was marked atrophy of the left serratus, giving rise to a typical angel-wing scapula. This was less marked on the right. In certain positions, the rhomboid major on the left was brought out prominently as a muscular band running from the middle of the vertebral border of the scapula diagonally in a median line, indicative of atrophy of the neighboring muscles. The left supraspinatus was markedly atrophied, the right less so; the trapezii were fairly preserved. Lungs, heart and abdomen showed no abnormality. The left arm at the last examination showed practically a complete paralysis with extreme atrophy

of all the muscles, including the deltoid. Inward and outward rotation were slightly preserved. The right arm showed much less disturbance of function. Movements could be executed with fair strength with the exception of extreme elevation. The intrinsic muscles of the left hand were extremely atrophied; of the right, as yet normal. Electrical examination of the affected muscles showed a partial reaction of degeneration; faradic irritability was not completely lost. The urine showed no abnormality.

Diagnosis. The essential feature of this case is a progressive atrophy of the muscles of the upper extremities, including the shoulder girdle, particularly marked on the left side, but now clearly beginning also on the right. In the absence of objective sensory disorders which this patient has at no time shown, and of other signs of structural disease, the diagnosis of Progressive Muscular Atrophy may be made with assurance. The differential diagnosis is not difficult. It cannot be mistaken for syringomyelia, because of the entire absence of sensory involvement, nor for peripheral neuritis on account of the method of onset, its progressive course and the absence of pain on pressure over the nerve trunks. Degenerations due to lead (see Case 5) may lead to confusion, a matter determined by the discovery of lead in the excretions and by a history of its possible ingestion. The spinal type of progressive muscular atrophy (Aran-Duchenne) usually first manifests itself through atrophy of the small muscles of the hand, supplied chiefly by the ulnar and to less degree by the median nerve.

Prognosis. This patient is a man of poor physique. The atrophy has progressed rapidly. It is, therefore, unlikely that he will live more than three or four years.

Treatment. The treatment is directed to a checking of the progressive atrophy. A cure of the condition is not possible, but it is altogether probable that its course may be in a measure stayed by abstention from the use of the muscles and the administration of tonic drugs of which strychnia is the best representative. Increasing doses of strychnia should, therefore, be given in the hope that thereby the progressive nerve degeneration may be checked.

Case 29. R., a woman of thirty-four, gave a history of excellent health and active life as a servant. Except for headaches she had been without disease of consequence. Her family history was of interest from the fact that her father, aunts and second cousins on her father's side had suffered or were suffering from the same muscular affection for which she sought advice. So frequently had the affection appeared in members of the family that it had come to be known by her family name in the place in which she lived. The course of the disease was, in general, gradual loss of power in the hands and arms and later in the legs. There was said also to have been some sensory disturbance.

For a period of four or five months the patient had noticed a feeling of numbness and beginning weakness of the small muscles of the left hand. There was some difficulty in holding objects firmly, and it was not possible to extend the fingers completely. There was no involvement of the left hand or of the legs. Examination showed the interosseous muscles of the left hand markedly atrophied without invasion of the forearm muscles. The left hand was colder than the right, but objectively sensation to contact and pain was entirely unimpaired. Electrical examination gave no faradic response in the small muscles of the hand, whereas galvanic stimulation gave a slow contraction with the cathodal closing contraction equal to the anodal closing contraction. The knee jerks were normal; the pupils showed no abnormality; the pulse was 80; the radial arteries soft and the heart normal.

Fig. 12. From a Case of Progressive Muscular Atrophy, showing Type of Ventral Horn Lesion.

Diagnosis. This case must be interpreted as an unusual family form of Progressive Muscular Atrophy in a very early stage. The complaint of sensory disorder, numbness and the

like is often made when no objective disturbance is discoverable. The examination gave no evidence that other elements than the motor peripheral neurones were affected. The evident family character of the disease is also strong evidence in favor of the diagnosis of muscular atrophy, although certain forms of this disease appear to be wholly lacking in this element of heredity. Atrophy beginning in the small hand muscles is significant (see Case 28).

Prognosis. The affection will be slowly progressive, invading successively the arm and shoulder muscles, later, possibly, the legs, if death does not sooner supervene, as a result of the gradual extension into the oblongata.

Treatment. The muscles, especially those involved in the process, should be protected from over-fatigue. Too vigorous treatment by massage or electricity is to be avoided. Strychnia should be given.

Case 30. O., a married man of forty-five, an expressman by occupation, had noticed a gradual loss of power in the right leg for seven or eight months, insidious in onset. He had had no injury although he was accustomed to carry heavy weights. At first he had slight pain in the muscles and nerves of the calf and later over the instep. This pain had continued to a greater or less degree. There was, however, none above the knee. There had also been some pain in the left leg and he had become apprehensive lest the same process were beginning in that leg. The pain had been dull and never lancinating in character. The right leg had steadily grown worse, so that when seen he had marked foot-drop with great difficulty in flexing the leg. The condition had been diagnosticated as muscular rheumatism. There was no history of other similar cases in the family.

The physical examination showed the left pupil slightly larger than the right, with a somewhat better light reaction on the right than on the left. The hearing was normal and the cranial nerves otherwise free. The arms showed no abnormality; the heart was normal; the pulse, 68 and regular. All the muscles of the right leg were weak and reduced in size; foot-drop was very marked and had existed practically from the beginning of the illness. Knee jerk was absent on the right, active on the left. No Achilles reflex was obtained on either side. The plantar was normal on both sides and there was no clonus. Sensibility was unimpaired, including sense of position. There was no pain over the nerve trunks. The right foot was somewhat cyanotic. The electrical examination gave no reaction to a strong faradic current in the muscles of the right leg, with normal reactions on the left. Galvanic stimulation gave CaC greater than AnC on both sides, but slow in character and with diminished excitability on the right.

Diagnosis. The probable diagnosis in this case is Progressive Muscular Atrophy of the Neural Type. It is to be distinguished from a localized neuritis in the fact that its course is progressively toward greater atrophy rather than toward recovery. Pain over the nerve trunks is less marked than in neuritis; the electrical conditions and the muscular

atrophy may for a time at least be the same in the two conditions. This type of progressive muscular atrophy is to be distinguished from the spinal type inasmuch as the ventral horn cells are not primarily involved, and that the disease throughout bears the stamp of a peripheral rather than a central type of degeneration. The fact that no other cases have occurred in the family speaks, somewhat, against the diagnosis of neural atrophy.

Prognosis. The prognosis is ultimately bad, although the course of the disease is exceedingly slow, and beginning, as it does, in the lower portion of the body does not invade vital areas as is ordinarily the case in the simple spinal progressive atrophy.

Treatment. Strychnia is indicated, in the hope of checking the progress of the atrophy. Massage and electricity are justified and helpful if applied in moderation. There is, perhaps, more danger of doing harm than good by the indiscriminate use of either of these methods of treatment. Avoidance of fatigue must be insisted upon, but at best the progress of the disease may be hindered and not completely checked by any means of treatment now at our command. The complete obscurity of the etiology renders the treatment still more uncertain.

Case 31. L., an unmarried woman of nineteen, for five years had complained of weakness of the arms. Her father was said to have had the same weakness. She had never been robust and had worked hard, particularly of late, when she had noticed special difficulty in lifting heavy articles. Her menstruation had been irregular and painful. She had had no difficulty with her stomach and had had no cough. Her sleep was satisfactory; her weight, 118½ pounds; hemoglobin, 80%.

Examination showed a weak-looking girl with round shoulders and expressionless face. Further investigation revealed that there was marked atrophy of both deltoids, together with most of the muscles of the upper arms, chest and back. The clavicles were particularly prominent. In the arms, the triceps and biceps on both sides were weak and atrophied, but the disturbance was more marked on the right side. The right serratus was also particularly weak, giving rise to an extreme prominence of the clavicle. The expressionless character of the face was due to weakness of both facial nerves, evidently a part of the general process. The pupils were normal, the thyroid slightly enlarged; the reflexes of the left arm were not obtained, but were weakly present on the right. There was no atrophy whatever of the leg muscles; the knee jerks were present and normal.

Diagnosis. This patient presented a condition of the muscles evidently not due to the ordinary progressive muscular atrophy of the spinal type, the distribution of which is primarily in the small muscles of the hand, and extending upward. In this case, the weak muscles were confined to the upper part of the body, face and upper arms. The forearms and hands were conspicuously spared. The case is, therefore, to be classified in the general category of the Muscular Dystrophies, rather than among the atrophies of the spinal type. The lesion differs on the pathological side in the fact that the degeneration of the muscles in progressive muscular atrophy is secondary to the involvement of the nerves, whereas, in the dystrophies the disturbance lies primarily in the muscles. No electrical reactions appear in the notes of this case. It may, however, be said that in

progressive muscular atrophy electrical alterations are much more conspicuous than in the dystrophic conditions.

Prognosis. The disease often occurs in several members of a family, as appears to have been the case here. Recovery does not take place. The progress of the disease is, however, exceedingly slow.

Treatment. Treatment of this condition is unavailing. Care should be taken not to over-exercise the already weakened muscles. The lifting which this girl was obliged to do should not be permitted. Massage in skilful hands may be useful, but here again extreme care must be taken not to tire the muscles.

Case 32. O., when first seen in January, 1905, was thirty-nine years old. Five years before, he had had a somewhat serious fall from a bicycle, but had recovered, although he was inclined, no doubt erroneously, to attach importance to this fall in connection with his later developing disease. Two to three years ago he had noticed gradually increasing weakness in the right arm, without pain. The right leg had troubled him in a similar way so that he had had difficulty in going up and down stairs. There was no venereal history, no headache or disturbance of the cranial nerve innervation. There had been some pain across the shoulders and through the spine, but of indefinite character.

Physical examination showed normal pupillary reactions. The right arm was evidently weak and carried close to the side. The right shoulder was carried somewhat higher and further forward than the left. The right trapezius was weak; there was no power in the deltoid; the biceps was very weak; the forearm muscles somewhat stronger. There was atrophy of the interossei, difficulty in flexion of the fingers and considerable general weakness of the hand muscles. The left arm also was weak with atrophy of muscles, but less marked than on the right. Electrical examination showed that most of the muscles were still responsive to faradism but required a stronger current than normal. Reaction of degeneration was obtained in the right biceps, but not in the small hand muscles. In the left arm indirect stimulation by faradism gave good reactions. The reflexes of the arms were not exaggerated. The right leg was much smaller than the left, the measurements being $1\frac{1}{2}$ inches less about the right calf than about the left, but this he said had always been so. There was no general atrophy, as in the arms. The knee jerks were very much increased; there was double ankle clonus; the Achilles jerks were both very active; there was no Babinski sign on the left and it was doubtfully obtained on the right. There was no atrophy of the small muscles of the feet. Sensation and sphincter control were unaffected. The heart was normal. There were fibrillary movements, especially over the back muscles. The urine showed no abnormality. During the succeeding six years

the condition grew very gradually worse, but with its essential features unchanged. The disability had greatly increased through the atrophy of muscles and consequent contractures, and the spasticity had reached such a point that walking was almost impossible, especially if it demanded going up or down stairs. No involvement of the cranial nerves had developed and his general health is wholly unimpaired.

Diagnosis. The combination in this case of atrophy, particularly of the upper extremities, with spasticity, particularly of the lower extremities, without sensory or sphincteric disturbance, progressive in course and without pain over the nerve trunks, permits of no other diagnosis than Amyotrophic Lateral Sclerosis (progressive muscular atrophy of the spastic type [see Fig. 5]). Death in this condition, as in spinal progressive muscular atrophy, usually results through ultimate extension of the process to the oblongata.

FIG. 13. CASE 32.

From a case of Amyotrophic Lateral Sclerosis; cervical region, showing coincident involvement of ventral horns and lateral (pyramidal) tracts.

Prognosis. The progress of the affection especially illustrated by this case is extremely slow. Changes from month to month are imperceptible; from year to year the increasing incapacity may be noticed. A complication, as in all highly spastic conditions, is the development of contractures with the consequent increased difficulty of locomotion or of the proper use of the hands and arms. In this patient a contracture of the pectoral muscles of one side was so great and the resulting disability therefrom so incapacitating that a muscle cutting was done with relief. It is now almost impossible for the patient to get about or to attend to his personal needs.

Treatment. Mechanical treatment vigorously applied from time to time has been of great assistance in overcoming

the tendency to contracture and in relieving the spasticity. Massage and particularly exercises by means of Zander apparatus have been particularly efficacious. Hydrotherapeutic measures have also given relief. Drugs have been unavailing. Surgical intervention, as stated above, has accomplished something through mechanically improving the posture.

Case 33. G., forty-five years old, had been married six years and dated the beginning of his symptoms to a period slightly before that. His chief complaint was pain in various parts of his body, feet, legs and arms. He had also had a girdling sensation with practically constant pain about the body, which ran up the back and into his head. He had lost in weight and generally was in somewhat poor physical condition, to such an extent that he had not worked for a year. He had had no trouble with his eyesight; his appetite in general was good, and difficulty in walking had not been a conspicuous annoyance. The pain, which he described as "just like putting a knife right into you," had been persistent and distressing. His legs, at times, had felt numb, his arms less so. He had had no difficulty in stomach digestion, the bowels had been regular, micturition somewhat frequent, possibly associated with slight incontinence. He admitted gonorrhea, but thought he had not had syphilis. There was a history of much sexual excess, and later lack of desire.

Examination showed slightly irregular pupils with extremely slight light reaction and excellent accommodation. The cranial nerves were otherwise normal. The arms were very slightly ataxic, but otherwise showed no abnormality in sensation, strength or reflexes. The knee jerk was active on the right but obtained with great difficulty on the left, unless reinforcement were used. There was no Achilles response, no Babinski, no clonus. There was slight objective disorder of sensation on the left foot, but the joint sensibility was, in general, adequate. There was very slight Romberg. A later examination showed less difference in the knee jerk of the two sides.

Diagnosis. This is evidently a typical case of Tabes in a somewhat early stage. The characteristic pain would be sufficient to make a highly probable diagnosis even in the absence of the pupillary changes and the altered reflexes. Lancinating pain is an early, almost constant and exceedingly important symptom of tabes. The pain is characterized by shifting locality, frequency in muscular regions, sudden onset and disappearance, sharp quality well described as

lancinating. It is often popularly mistaken for rheumatism.

Prognosis. Tabes is not in itself a fatal disease. Death occurs from complications usually on the part of the kidneys and bladder rather than from the invasion of vital areas by the progressive nerve degeneration. In this case the outlook for a long period of relative usefulness is good, provided the patient adheres to a strict manner of life and avoids excesses of all sorts.

Treatment. The important elements in the treatment are, relief of immediate symptoms, training in coördination and care of the bladder. The lancinating pains are difficult to combat. Aspirin is useful to palliate the pain, but is wholly inefficient to control a severe paroxysm. Morphine is often a necessary resort and codeine by mouth is frequently useful although both it and morphine should be used as sparingly as possible. The gastric crises are self-limited and must be treated on the general principles applying to extreme pain. Coördinative exercises following the directions given by Fraenkel were employed in this case with excellent results. This form of treatment should be urged upon patients before the ataxia has become so extreme as to render it relatively inefficacious. The urine should be examined repeatedly, and urotropin should be given to ward off cystitis. If there is residual urine, bladder washings should be systematically carried out. By scrupulous care in these regards, there is no doubt that life may be materially prolonged. Regularity in the passage of urine does much to overcome retention and incontinence. The administration of salvarsan (Ehrlich's "606") is still in its experimental stage. Favorable reports are at hand, but the procedure should not be made a general one until a much wider experience of its action accumulates in the treatment of other than the metasyphilitic affections.

Case 34. I., married, fifty-one years old, had been exposed to venereal infection fifteen years ago; immediately, thereafter, he had had persistent sore throat, but no other signs of syphilis, and no known local sore. He was well until about four years ago, when he began to have sharp pain in the axillæ and legs, which continued to the time of examination in May, 1910. The pain was at times so severe as to demand morphine. Three or four years before he had a paralysis of the right lid, which had never wholly recovered. Beginning in 1909 he had gradually lost the sight of that eye; he had had no trouble with the left eye, and there was no history of diplopia. Very slight difficulty in walking had developed; it had become difficult to pass urine freely, but there had been no incontinence; sexual desire had diminished. There had been no girdling pains, no vomiting or stomach difficulty. He had not observed any unusual numbness of arms or legs, and he was able to write well. In spite of the pains which were of daily occurrence he had continued at his work in a factory. The bowels had been costive.

Examination showed unequal pupils, the right slightly larger than the left; no light reaction in the right; considerable in the left with good accommodation in both. The right optic nerve was atrophied. Except for slight persistent ptosis of the right lid, the cranial nerves showed no further involvement. There was slight ataxia of the arms, with unimpaired strength, and normal objective sensibility. Knee jerks and Achilles reflexes were not obtained; there was no ankle clonus, and the plantar response was difficult to determine on account of extreme ticklishness of the soles. The Romberg sign was slightly present. The heart, pulse and blood pressure were normal.

Diagnosis. The presence of an Argyll-Robertson pupil, lancinating pains, sphincteric disorder, with absence of knee jerks, makes this an unmistakable case of Tabes. In the early stages, marked objective disorders of sensation are often conspicuously absent, which accounts for the slight development of the Romberg sign. Syphilis is presumably a constant etiological factor in tabes, and may frequently be demonstrated in those cases where the original infection

passed unnoticed, by the recently perfected Wassermann serum test. Certain types of neuritis (see Case 2) may closely simulate tabes, but in the former motor weakness and pain on pressure over nerve trunks, in the absence of Argyll-Robertson pupils and sphincteric disorder, should usually determine the diagnosis. Sharp pains may occur in both conditions, but they are much less characteristic in neuritis, and do not, as in tabes, extend over many years — often ten or more.

Prognosis. With care, this patient should live for many years with gradually decreasing usefulness. The fact that he has lost the sight of one eye through optic atrophy renders it probable that the other eye will ultimately undergo the same degeneration.

Treatment. The treatment in this case was relief of the pain, together with general directions as to living and exercises, as indicated under Case 33.

Case 35. C., a woman fifty years old, three years before being seen had had pain in one heel. Thereafter she stated that she was paralyzed from her waist down, both as regards sensation and motion. She was in bed for three months and gradually recovered from the paralytic condition. The pain extended into the knees and there was considerable numbness in the legs with a staggering gait which had persisted up to the time of the examination. There had been no trouble with the sphincters.

Examination showed irregular pupils, the right responding to light much better than the left, which, however, retained some slight light reaction. The accommodation was normal, the fields normal, and the cranial nerves otherwise uninvolved. There was slight ataxia of the arms without demonstrable sensory disorder. The strength of the legs was unimpaired; there was no knee jerk, no Achilles reflex and no plantar. There was blunting of sensation with disordered sense of position in the feet, associated with an extreme degree of swaying with the eyes closed (Romberg sign). There was some rigidity of the radial arteries and a systolic murmur at the heart base. The pulse was regular and of normal rapidity.

Diagnosis. This patient undoubtedly was suffering from Tabes. The pupillary condition, sensory disorders of the legs and absent deep reflexes, with retained motor power, are sufficient to confirm the diagnosis. The original attack, three years before, with an asserted paralysis of the legs, is not possible to interpret on the basis of tabes. It is probable the observation of the patient was incorrect, and that either the paralysis was not so complete as she supposed or that the sensory and motor disturbance extended beyond the legs to other parts of the body. In that case, a peripheral neuritis would be explanatory. A myelitis would not have shown so complete a recovery. In any case, the symptoms as observed three years later were typically those of tabes.

Prognosis and Treatment in this case are not different from that already outlined.

Case 36. A., thirty-nine, married, one child fifteen years old, had suffered for ten years with pain in her back, shoulder blades and also lower down. She had been distended with gas, constipated and at times slightly jaundiced. She had had difficulty with her stomach for which she had been treated since the age of twenty. At nineteen she had had pain in the neighborhood of the left breast with general weakness. At the time of examination she had many complaints of sensations of heaviness, weakness, shortness of breath, vertigo, occipital pain and pains in the limbs. She maintained, however, that she has not worried about these disorders.

Examination showed the right pupil much smaller than the left, with no light reaction whatever, but with retained accommodation; the fundus was pale on both sides; the elbow jerks were active; the knee jerks normal; there was slight swaying with the eyes closed. The heart showed no abnormality; pulse 96, regular; blood pressure about 130. On further questioning it appeared that for some years she had had sharp lancinating pains in the legs, that her stomach disturbance certainly of late was also associated with pain and came rather in attacks than as a constant disability. It appeared also that at one time she had been catheterized for three days. The feet and hands were usually cold, but there were no other subjective disorders of sensibility.

Diagnosis. This case had been taken for one of psychasthenia and no suspicion of organic disease had been entertained. The combination, however, of Argyll-Robertson pupil with very typical lancinating pains, together with transient disturbance with the sphincters and presumable gastric crises renders the diagnosis of Tabes practically certain in spite of the persistence of the deep reflexes, notably of the knee jerks. It is, however, probable that in this case there is a combination of psychasthenia of long persistence with tabes of more recent development. The interest of the case from a diagnostic standpoint lies in this fact. It would be well to make a thorough objective sensory examination and to determine the possibility of earlier syphilitic infection.

Prognosis. So far as the tabetic process is concerned this patient should do well. The situation is, however, compli-

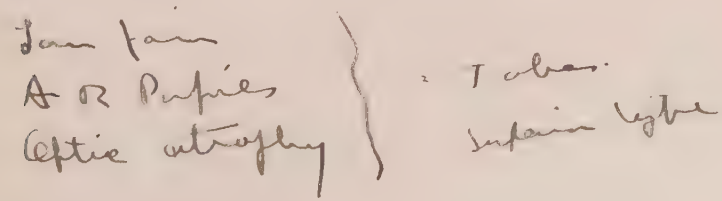
cated by her definite psychasthenic attitude, which presumably will not tend to shorten her life but which will undoubtedly render it much more miserable than it otherwise would have been with the handicap alone of tabes.

Treatment. The tabes should be treated on general principles. The psychasthenic state demands careful investigation to the end that its causes may be discovered and mental means provided to meet the situation. The patient has passed from observation.

Case 37. L., thirty-nine years old, stated that, six months before, he had noticed dimness of vision, which had increased. There was special difficulty in differentiating colors, so that his capacity for work, that of a salesman, was seriously affected. Fourteen years before he had had " rheumatism " with sharp pain in his right leg, which came and went quickly. He had had some " twinges " since in that leg but only after exercising. These pains were also sharp, quickly over and not severe. Gonorrhea was acknowledged, syphilis denied. He had formerly been a heavy drinker, but when seen and for some years previously had neither smoked nor taken alcohol. In general, except for the condition of his eyes, he considered himself well. Questioning showed that he had at no time had difficulty in micturition, uncertainty of gait, girdling sensation or other disorder of sensibility.

Physical examination revealed slightly unequal pupils; no light response with retained accommodation (Argyll-Robertson pupil) and pronounced optic nerve atrophy. There was no ataxia of the arms; the knee jerks were active; there were no objective sensory disorders and no swaying with the eyes closed (Romberg sign). The heart was normal, pulse 80 and blood pressure 140.

Diagnosis. The combination of lancinating pains, Argyll-Robertson pupil, with optic atrophy, makes the diagnosis of Tabes certain in this case, in spite of active knee jerks and the failure of other signs. The superior type of tabes, characterized by early optic atrophy, is usually for a long period unassociated with other signs, justifying in part, or at least explaining, the statement that the usual tabetic symptoms are checked by optic nerve atrophy. The confusion of lancinating pains with " rheumatism " in the mind of the patient should always be borne in mind. It should also be remembered that tabes is one of the few conditions in which primary atrophy of the optic nerve occurs.



Case 38. C., thirty-four years old, was admitted to a hospital March 1, 1898. Her occupation had been circus riding. In her family history the only points of importance were, that her mother had died of tuberculosis and that of seven brothers and sisters but one is now living, one of the others having died of tuberculosis and one of meningitis.

The history given was that in 1889 she was thrown from a horse but not seriously hurt. She was able to go on with her work and noticed no other symptoms than sharp pains. During the years 1890 and 1891 she noticed occasional disturbances of sensation in the sole of the left foot and in the right knee. She discontinued her work as circus rider for two years. In 1894 she began work again, riding as before, but not so well. There appears to have been at this time some disturbance of sensation and some ataxia, especially after excessive exercise. She worked, however, for two years, until 1896, but discontinued riding. She still had pains. In 1897 she fell a distance of four steps, striking on the lower part of her spine, but continued to work for three weeks with a gradual feeling of unsteadiness while on her feet. At the end of these three weeks she had a sudden feeling of faintness and quickly and completely lost control of her legs. They felt "dead." She was unable to go upstairs, and urinary disorders set in. She suffered intensely from stomach pain associated with vomiting, — typical gastric crises, girdle pains, excessive constipation and occasional definite delirium. She had undoubtedly contracted syphilis from her first husband, and had been to a certain extent addicted to alcoholic liquors. She had suffered from dysmenorrhea and irregular menstruation as long as she could remember, and also stated that she had had incontinence of urine until her twelfth year. She had had two living children, both of whom died in infancy, and four miscarriages; two children had been born prematurely and two were stillborn. The patient was also possessor of a so-called elastic skin.

Physical examination in the hospital showed a somewhat emaciated woman, wholly incapable of standing, even with considerable assistance. The knee jerks were absent. The pupils failed to respond to light but continued to respond on

accommodation. The condition of the legs showed no muscular atrophy, but a very marked flaccidity at the joints. Gross strength was not impaired but incoördination was absolute. Examination of sensation showed a complete absence of all forms in the legs extending up to the abdomen.

While in the hospital she had various attacks, differing in character, of mental disturbance. At one period she showed considerable evidence of mental excitement, threatening suicide and manifesting various unsystematized delusions. Later, for a period of about two months or more, she was apparently in a deeply depressed condition, refusing absolutely to talk and manifesting no interest whatever in her surroundings. During this period she at times refused to take food, was stuporous, lay with eyes half closed, moved but little and required artificial feeding. She answered no questions and appeared not to understand the significance of the bedpan. She made no complaints at this time of physical pain, and at times indicated by a nod that she felt better. Following this there was a period of cheerfulness associated with more or less incoherent talk. This also passed and she finally apparently became entirely rational and capable of interesting herself to a certain extent in affairs about her. She also suffered intensely at times from gastric crises. Examination of the internal organs at no time until toward the end of her life showed any abnormality. Under these conditions she gradually failed, and death finally resulted, January 27, 1901, with development of ulcers and bedsores, facial erysipelas and a terminal pneumonia.

Fig. 14. Case 38.
Sections through cervical, thoracic and lumbar regions, showing dorsal degeneration.

Autopsy. Autopsy very shortly after death showed a certain amount of pleuritis; edema of the lungs, with areas of tuberculosis; degeneration of the dorsal columns of the cord and an apparent atrophy of certain portions of the brain. There was also cloudy swelling of the liver and

kidneys. Microscopic examination showed an extensive and typical tabetic degeneration throughout the cord, evidently of long standing.

Diagnosis. There was at no time difficulty in the diagnosis of this case. The altogether probable venereal history, together with early sharp pain, sensory disorder, ataxia and later lost reflexes and characteristic pupillary changes render certain the diagnosis of Tabes. The case is of interest, especially from the associated disturbed mental state which justified the diagnosis borne out by the autopsy, that the tabes was associated with cortical degeneration of the nature of dementia paralytica. The diagnosis may, therefore, properly be made of so-called Tabo-paralysis. This is a not infrequent combination and justifies the assumption of a common etiology of the two affections and their general similarity except in relation to the portion of the nervous system mainly affected.

Prognosis. The patient was carefully nursed at the hospital, but died finally of ulcers and bedsores with an ultimate facial erysipelas and terminal pneumonia. She had lived about twelve years from the onset of the first symptoms.

Treatment. When this patient came under observation her disease was far advanced. Treatment, therefore, consisted merely in rendering her as comfortable as her distressing condition allowed. Her various symptoms, gastric crises, lancinating pain and discomforts both mental and physical were treated as they arose. (See previous cases of tabes.)

Case 39. A., a man of forty-nine, unmarried, was admitted to a hospital, June 8, 1901. Nothing of his family history bearing on the present condition was obtained. He had had typhoid fever when a young man and in 1882 syphilis, for which he was treated with apparent success. Since 1888 he had taken alcohol in excess.

About three years before entrance to the hospital he noticed a dull, constant pain which occupied small areas at the front of the abdomen at the level of the umbilicus. He did not notice any pain in his back. He had no nausea. He took medicine which seemed to improve the condition but led to a facial eruption. At the end of a year he was relieved of this pain, but in the summer of 1898 he noticed a cold area about the size of a hand just below both knees. This gradually enlarged and a feeling of numbness supervened in the cold areas. His feet became involved in the sensory disorder and he felt as though "walking on a thick carpet." In the winter of 1899 paresthesia of the legs developed, and his knees felt as though "in a vise." These disorders of sensation involved the legs from below upwards. During this period and up to April, 1900, he was able to walk steadily, whether in light or dark, and had no disorder either with his sight or handwriting. Since that time, however, his eyesight had gradually failed, so that at the time of entrance to the hospital he was wholly unable to read. His fingers had also begun to feel clumsy and cold, but there was no paresthesia or numbness of the arms. His handwriting became much impaired. In February, 1901, he noticed a feeling of cold which gradually extended from the legs up to the level of the nipple. Up to six months before entrance he was able to walk, then gradually lost power in his legs until they were practically totally helpless. He had no disturbance of deglutition or articulation.

Physical examination showed a poor reaction on the part of the pupils both to light and with accommodation. His vision was poor. He could not count fingers at a distance of ten feet, nor could he read ordinary type. Lungs and heart were normal. A slight fibrillary twitching was noted over the pectoral region and in the muscles of the upper arm. His hand grasp was good, but there was general disturbance

of temperature sense over the body and arms. His legs and toes could be moved very slightly. His legs assumed a semi-flexed position. The knee jerks were very much increased; ankle clonus and Babinski reaction were present. The tactile sense also showed some impairment. Later a marked disturbance in control of the sphincters came on and a certain mental failure became apparent. The hemoglobin was 60%; whites, 12,800; reds, 5,284,000.

On June 28, 1901, it was noted that the patient was progressively failing, both physically and mentally. He had become emaciated, was dirty in his habits and practically helpless. He died July 8, 1901.

Autopsy. The post-mortem examination showed a high degree of arteriosclerosis of the vertebral arteries and of the circle of Willis, together with an appearance of atrophy of certain portions of the brain surface. Frontal sections of the brain showed cystic formation in the region of the internal capsule. The spinal cord showed a definite diffuse combined generation localized predominantly in the dorsal and lateral tracts. The microscopic appearances were neuroglia sclerosis combined with vacuole formation and fat granule cells in the degenerating area with accompanying degeneration of myelin. The degeneration was most pronounced in the thoracic and cervical regions. The oblongata was entirely spared.

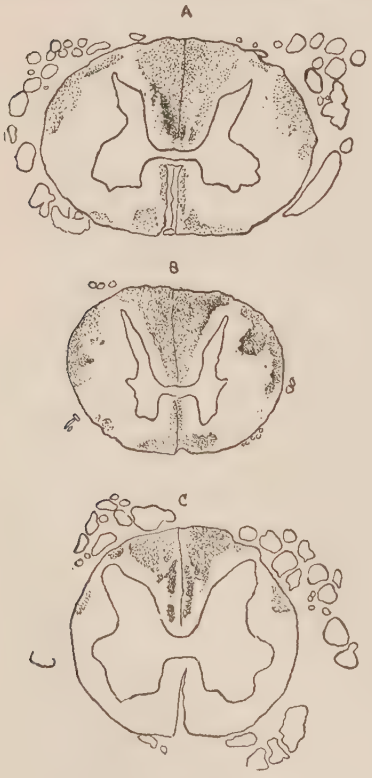


FIG. 15. CASE 39.
A, cervical; B, thoracic; C, lumbar, showing diffuse lesions in a case without anemia. Accurate tracings, Edinger drawing apparatus.

Diagnosis. The etiology in this case was obscure beyond the fact of a general arteriosclerosis. The clinical diagnosis substantiated by autopsy was Diffuse

Combined Degeneration of the spinal cord, giving rise to the symptom complex of Ataxic Paraplegia. This condition is to be distinguished from a transverse myelitis by the fact that various regions of the cord are invaded and that the onset is insidious. When the disease is well established, confusion may arise between these two conditions. It is to be sharply distinguished from tabes by the general exaggeration of the reflexes and the absence of Argyll-Robertson pupil and lancinating pains. The conspicuous sensory disorders are sufficient to separate it from amyotrophic lateral sclerosis. Pain and localizing signs should usually prevent confusion with a spinal tumor (in this connection see Case 56).

Prognosis. The prognosis is ultimately bad, but the course of the disease is extremely variable and impossible to predict with any degree of certainty. It not infrequently runs its course in from one to two years from the appearance of the first symptoms, or again it may extend with varying intensity over a period of many years. Our present knowledge does not permit us sharply to subdivide the different varieties of the general lesion.

Treatment. Treatment should be directed toward the general condition rather than toward the definite lesions of the cord. Occurring as the disease often does in cachectic individuals, a general supportive and tonic treatment is desirable. Regulation of the diet, exercise and general hygiene are far more important than drugs. Strychnia may be used with discrimination, and massage and electricity fill a certain place. The Fraenkel coördinative exercises are far less useful in this condition than in the uncomplicated ataxia of tabes.

Case 40. S., a woman sixty years old, unmarried, a seamstress, was well up to the spring of 1900 except for occasional attacks of rheumatism. She then began to have sensations of numbness in the fingers, but not affecting the body or the arms. In spite of the fact that her fingers felt as if "asleep," she was able to sew and make highly coördinated movements. In July she began to have similar sensations in her toes, which gradually spread until in October both legs were entirely involved. Excepting for the numbness she considered herself perfectly well. There was no disturbance in walking. Her appetite was good and her bowels regular; nothing of importance was learned regarding her family history. Seen October 8, 1900, she had an anemic appearance and her gait was slightly ataxic. Heart and pupils showed no abnormality. The knee jerks were slight.

A blood examination, November 20, gave the following results: Hemoglobin, 25%; red cells, 1,850,000. Differential count of 500 white cells; polymorphonuclear neutrophiles, 71.8%; basophiles, small, 25.2%; basophiles, large, 1.6%; eosinophiles, 1.4%. In the white count two megaloblasts and four normoblasts were seen. There was considerable poikilocytosis; many oval forms; excess of macrocytes; some microcytes.

On December 5 a note was made that the legs were very rapidly becoming weak and ataxic so that the patient was able to walk but a few steps at a time and very unsteadily. December 18 she entered a hospital, remaining until April 29. During that period, under general tonic and hygienic treatment, she improved considerably. A second blood examination showed a still further reduction in the red cells with poikilocytosis, hemoglobin 45% and 14,000 white cells.

After leaving the hospital she began again to fail, although her appetite remained good. She became more ataxic and by the middle of July could not move her legs while in bed, and very imperfectly while sitting in a chair. She could not stand alone. Her bowels were very constipated, with about one movement a week, in spite of attempts at catharsis. August 15, without warning, she fell, was taken up unconscious and remained so for several hours. She was then de-

lirious and helpless, vomited once or twice and had excessive diarrhea for several days. She failed rapidly and died, August 30, without recovering complete consciousness.

Autopsy. Examination of the cord macroscopically showed small evidence of the lesion. On microscopic examination degenerations in the white matter, sharply limited to the dorsal and lateral tracts, were evident, the type of degeneration similar to that described in Case 39. In the thoracic region the lesions were distributed as in the cervical, over the dorsal and lateral columns. In the lumbar region, on the other hand, sclerosis was limited to the pyramidal tracts. Except for extreme pigmentation, the ventral horn cells were normal.

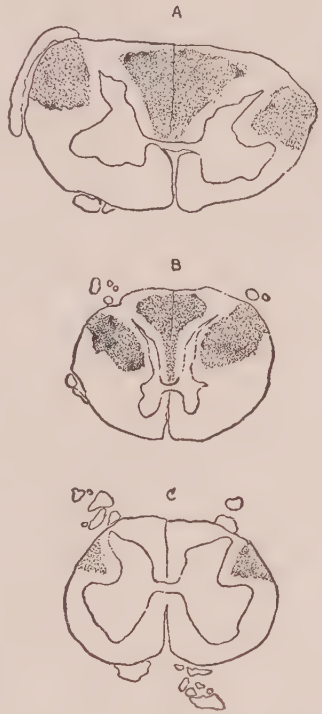


FIG. 16. CASE 40.

A, cervical; B, thoracic; C, lumbar, showing somewhat circumscribed lesions in a case with pernicious anemia. Accurate tracings, Edinger drawing apparatus.

Diagnosis. Cord lesions of the type of combined degenerations appearing clinically as Ataxic Paraplegia are frequent in Anemia of the pernicious type. In all cases, therefore, of sensory disorder combined with spasticity the blood should be examined, and, conversely, in anemias the nervous system should be carefully investigated with special reference to the existence of this lesion. Sensation and the condition of the reflexes should have been examined in this case. For differential diagnosis, see Case 39.

Prognosis. The outcome of cases associated with pernicious anemia depends rather upon the blood state than upon the cord lesion.

Treatment. Treatment should therefore be directed toward improving the condition of the blood by diet, iron, arsenic and general hygienic measures.

Case 41. E., an unmarried woman of forty, gave the following history. She had been well up to nineteen, then when at school she began to walk with difficulty, so that in a short time she was unable to get about unassisted. Attempts at treatment did not result in improvement. At the end of six months she was wholly unable to walk and felt cold and numb to her waist line. After this, she apparently improved somewhat but soon lost what she had gained, so that for the past ten years she had been totally helpless so far as the control of her legs was concerned. In addition to the motor disability, she had had much sensory disorder in the legs with partial loss of sphincter control, marked by both retention and incontinence, especially when lying down. Some cystitis had developed.

On examination the cranial nerves showed no involvement. The pupils were normal and equal and reacted properly to light and on accommodation; the visual fields were normal. The arms were not paralyzed and gave lively normal reflexes at elbows and wrists, with unimpaired sensation. There were no abdominal reflexes. Below a line three to four inches above the umbilicus, extending around the body at that level, there was absolutely no sensation to prick or contact. Muscular sensibility was entirely lacking. At and below the right knee there were scars, apparently the result of burns. The knee jerks were greatly increased; there was no ankle clonus, presumably on account of contractures; there was double Babinski sign; the Achilles jerks were not obtained. The back showed no deformity. There was an escape of urine during the examination.

Diagnosis. The etiology in this case is obscure. Tuberculosis (Pott's disease) is a common cause of transverse lesion of the cord, particularly in young persons. The fact that no kyphos had developed is presumptive evidence that this was not the cause in this instance. There was no history of an acute infection, the process was somewhat gradual in reaching its height, and there has been no change for ten years. Tumor of the cord may be excluded because of the lack of pain and the evident stationary character of the process. The exact cause of the lesion must, therefore, be left undecided.

Its results are evident, namely, a practically complete transverse lesion of the cord in the lower thoracic region. That the lesion was not completely destructive of the cord is shown by the fact that the reflexes were retained and active in the legs. (In man, experience shows that a complete transection of the cord permanently destroys the deep reflexes.) The

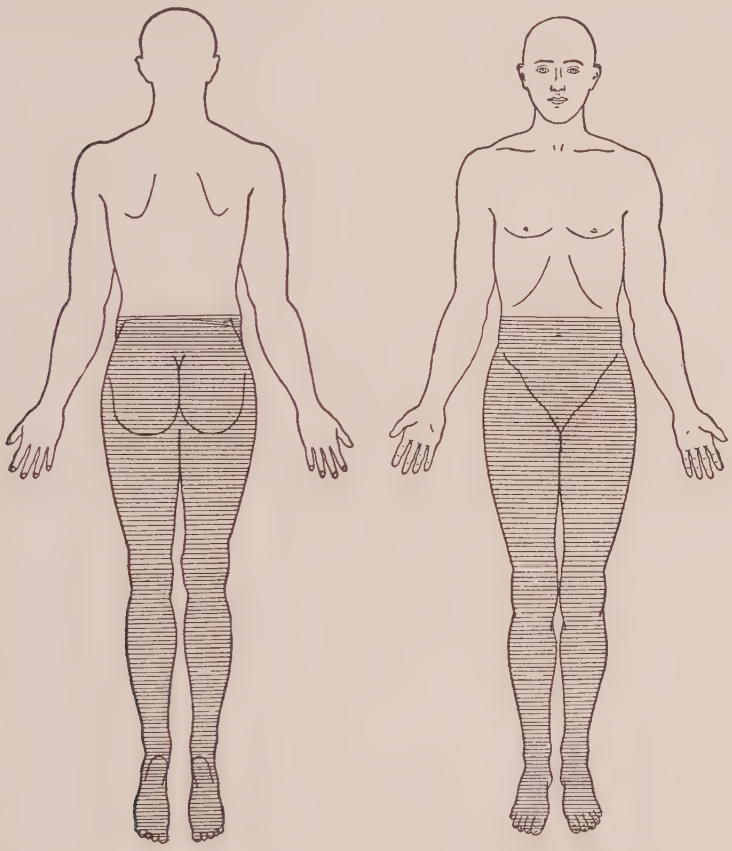


Fig. 17. Case 41. Showing extent of anesthesia.

combination of symptoms, — paralysis of motion and of sensation, with disturbance in sphincter control below a given level, is pathognomonic of localized transverse cord lesion, ordinarily described as Transverse Myelitis.

Prognosis. Considering the lapse of time since the onset of the lesion there is small likelihood of material improvement. Danger to life depends upon negligence in physical care.

Treatment. The treatment is largely palliative and prophylactic. Particular care should be taken of the bladder condition to prevent cystitis and to obviate its resultant complications. It is desirable to use urotropin to assist in the sterilization of the urine. Duration of life depends essentially upon the faithful observance of strict surgical cleanliness, since the disease itself is not fatal.

Case 42. H., a man of fifty-two, was first seen in April, 1910. He gave the following history: About one year before, he had had pain in the right leg not sharply confined to any one nerve distribution. This improved and he was in general well and able to work during the summer of 1909. In September, he had more pain and noticed some weakness of the legs. Finally, the legs gave way suddenly so that he would have fallen had a seat not been near. He was able to get up, but walking was practically impossible on account of weakness. The following month he was completely incapacitated, had considerable general pain and both legs were involved. He had some retention of urine followed by incontinence, but did not require catheterization.

Examination showed normal pupils and no involvement of cranial nerves. There was no headache or other head symptoms. Both arms were strong, but the left was distinctly smaller than the right with less active reflexes and with considerable atrophy of the small muscles but without significant impairment of function. This condition had, however, existed for many years and could not be brought into relation with the main difficulty. The abdominal reflexes were present, the cremaster not obtained; the knee jerks were lost; there was no clonus, Babinski, plantar or Achilles. Motion of the legs was possible in all the muscles, but weak. There was considerable atrophy, especially on the left side. Sensation in the feet was somewhat impaired and there was considerable loss of sense of position. The heart was negative, pulse 108, blood pressure 150. Apart from the legs, the general condition was excellent and the patient felt that he was improving.

From that time on for about two months, under faithful treatment by massage and exercises, some definite progress was made, so that he was able to get about to some degree. In June, however, he grew worse rather suddenly and the paralysis became almost complete. When seen in January, 1911, he was in a decidedly worse condition than at the first examination in April. He had developed a bedsore over the lower portion of the spine, and cystitis, controlled fairly well by urotropin, had come on. The arms were still unaffected.

The abdominal reflexes were active; the cremaster, the knee jerks, Achilles, plantar and ankle clonus, as before, entirely lacking. Motion was very weak in both legs, but somewhat more so in the right. There was no movement in the feet; flexion and extension at the knees and hips very slightly possible. Abduction and adduction of the thighs were greatly impaired. There was manifest atrophy of both legs, masked somewhat by fat and edema of the feet. Sensation of the legs from the hips down was diminished, more markedly so in the feet and legs than above. The saddle-back area and scrotal region were involved in the disordered sensation. There was no zone of hyperesthesia above the level of diminished sensation. There was constant urinary incontinence.

Diagnosis. The nature of the lesion in this case was not apparent at the first examination. It pointed rather to an invasion of the ventral horns of the cord in the lumbar region of the nature of a poliomyelitis, since the disorders of sensation were extremely slight as compared with the motor disability. Later examination, however, makes it perfectly clear that there has been a destructive lesion of the lumbar segments of the cord reaching as high as the first lumbar, best classified as Transverse Myelitis not completely destroying the cord. The signs of this lesion are, disordered sensation, paralysis of motion and disturbance of the sphincters below the point of the lesion. The absence of acute pain and the general course of the affection render tumor unlikely. The etiology is obscure but presumably depends upon a vascular condition possibly induced by an unknown infection.

Prognosis. With care this patient's life is not seriously threatened. Any laxity on his part or on the part of those caring for him, however, will easily lead to bladder complications and to the formation of destructive bedsores, either of which would hasten a fatal outcome.

Treatment. The patient has been faithfully treated by massage and electricity with a certain amelioration of his condition. Scrupulous care and cleanliness are the essential matters of importance. The damage to the cord being irremediable, the treatment resolves itself into means of prevention of further disaster rather than an attempt at cure.

Case 43. I., a man of forty-four, six months before being seen had fallen about twenty feet, presumably striking on his back. He did not lose consciousness. His right leg was particularly hurt and he supposed he had broken his hip. For three months succeeding the fall he had complete urinary retention, which was then succeeded by incontinence. The bowels were constipated. For two months he had had no severe pain. At the end of that time, however, he began to suffer constantly from pain through the right side. He had had a bedsore for three months.

Examination showed both knee jerks lost, no Achilles, no plantar, no clonus. The right leg was completely flaccid, with no motion whatever possible. There was some slight movement of the left thigh and leg but none of the foot. The toes were held in sharp plantar flexion. The cremasteric reflex was lacking on the right, active on the left. The abdominal reflex was more active on the right than on the left. There was some deformity of the back in the lower thoracic and lumbar region. The sensory disturbance in the legs was as follows: On the right, sensation was completely lost below the knee, extending upward to about the rim of the pelvis and to within an inch or two of the umbilicus. There was spontaneous pain in the left thigh. The left buttock was also numb, the right less so. The left leg showed complete loss of sensation in the foot, slight loss on the inner side of the leg, partial loss on the outer side extending up as far as the knee. The penis and scrotum took part in the sensory disturbance.

Diagnosis. There was in this case presumably a Fracture of the Spine in the lower thoracic region, leading to a definite destruction of the cord on the right side and much less serious damage on the left. The pain in the right thigh is to be explained by pressure on sensory nerve roots, possibly through splintered bone but more probably through hemorrhagic exudate at the level of the lesion. The fact that the pain grew worse two months after the accident is presumably due to the constriction of the nerves by the organized blood clot. The absent knee jerks must be explained by the destruction of that segment of the lumbar cord through which the reflex arc passes.

Prognosis. Improvement but not recovery is to be expected.

Treatment. Exploratory operation is justified if the pain persists and is severe. It is not to be supposed that a laminectomy would have any effect in relieving the long-standing degeneration which the cord evidently has undergone.

Case 44. S., a fisherman, thirty-nine years old, on October 14, 1909, struck his head violently against the boom of his vessel as he was passing under. He was thrown to the deck, striking on the back of his head. His tarpaulin mitigated somewhat the severity of the blow. He did not lose consciousness and was able to speak, but was unable to move either his arms or legs and had a sensation of numbness over his body and extremities. In about twenty minutes sensation began to return in the left index finger, then in the left hand and arm. The following day his right leg began to recover, but the right arm and the left leg were still, when seen February 1, 1910, definitely affected. The left arm and the right leg had practically recovered but he had noticed that the arm "went to sleep easily in the afternoon." There had also been general improvement in strength. There had been no urinary disorder, but he had been more constipated than before the accident. There had been no definite headache and no vomiting, even immediately after the injury. He had not been able to return to his boat on account of general nervousness. He had noticed that on standing with the head bent forward he experienced a sensation as of electricity passing through him over the chest and from the elbows to the tips of the fingers. On bending his head backward he had a similar sensation. He had also had considerable pain between the shoulders, especially when lying on his back. There was some pain also over a small area on the left abdomen. His feet had been cold, but this was associated with burning sensations, and the left foot had swollen somewhat at night.

Examination showed the following conditions: The pupils were normal and the cranial nerves uninvolved. The arms were both somewhat weak but more on the right than on the left. The wrist and elbow jerks were very active. There was diminished sensation on the outer side of the arms. The disturbance was greater on the right than on the left. The legs were less affected, but the knee jerks were very much increased; there was double ankle clonus rather more marked on the right than on the left; both Achilles reflexes were active, but there was a slight normal plantar reflex. Sensation in the feet was unimpaired. There was no Romberg sign.

The left leg was much weaker than the right, the right being essentially normal.

Diagnosis. In this case, the injury was evidently by *contre-coup*, as often seen in diving accidents. Immediately after the blow the entire spinal cord from a point in the cervical region temporarily lost its function. The subsequent course and outcome, however, demonstrated that the lesion was not transverse, and that it affected incompletely a region of the cord at the level of the fifth cervical segment, as shown by the final areas of disturbed sensibility. The increase of deep reflexes in the legs shows that the injury to the cord had distinctly invaded the pyramidal tracts, leaving intact the sensory fibers from the legs and body. Sharp localization of sensory disturbance in the arms makes it probable that the nerve roots were involved in the process rather than the cord itself.

Prognosis. The outcome in this case has been unexpectedly favorable. It is evident that the injury is far less severe than was at first thought probable. Recovery is, however, not likely to be entirely complete.

Treatment. Natural processes are most efficacious in such a case as this. Care should be taken not to over-exert the damaged parts of the body and to assist in their restoration by massage and other mechanical means of treatment.

Case 45. T., sixteen years old, was shot by a 38-caliber revolver at a range of about two feet, the bullet striking about one inch above the sternum slightly to the right of the median line between the insertions of the sterno-mastoid muscles. The exit of the bullet was half an inch above the upper surface of the scapula, a quarter of an inch to the left of the median line, having passed through the vertebral column. The boy was not unconscious and had no pain at any time. He fell to the floor with immediate and complete loss of control of the legs and of the bladder, together with loss of sensation in the lower part of the body and in the legs. There was rapid improvement in sphincter control and in sensation, but the paralysis of the legs persisted. There was at no time any temperature.

Examination showed widely dilated but normally reacting pupils and unaffected cranial nerves. There was no disturbance of motion or sensation in the arms beyond the fact that the left hand was constantly closed. There was numbness in the right axilla and below but the sensation was not lost. There was less, but still definite, disturbance on the left side. At the level of the crests of the ilia, reaching anteriorly to about the level of the umbilicus, sensation was practically lacking. There were no abdominal or epigastric reflexes. In the right leg there was sensation in the thigh to pain stimulation, but not below the knee. In the left leg there was practically no sensibility excepting a doubtful area about the knee. There was no voluntary movement of the legs. The knee jerks were, however, normally present; the Achilles jerks were active; there was no plantar reflex and no clonus. The back was slightly sensitive, but pricks felt as if a " cloth were over it." The skin was somewhat broken over the left buttock.

Diagnosis. The bullet in its passage through the spinal column evidently injured the cord at the lower cervical level without completely destroying it, as shown by the fact that sensation was still present below the point of the lesion, although greatly altered. It is evident that the dorsal columns, particularly in the median portion, were more involved than other portions of the sensory tracts, and that the pyramidal tracts were invaded to a considerable degree. It is

of interest that the knee jerks remained essentially normal under these conditions.

Prognosis. A permanent disability of the legs is sure to persist.

Treatment. The treatment, as described under Cases 41 and 42, is dependent upon a clear recognition of the danger of bedsores and of bladder complications in conditions of body and leg anesthesia.

Case 46. O., a young woman athlete, fell thirty feet from a trapeze into a net, bending her head violently forward in such a way that there was a fracture of the spine in the region of the sixth cervical segment. Complete paralysis of motion, sensation and of the sphincters below the point of injury occurred at once. A laminectomy was done, disclosing a crushed cord without external hemorrhage. Death resulted on the third day.

FIG. 18. CASE 46.
Showing damage to cord at three levels: (1) mid-cervical, (2) lower cervical, (3) thoracic.

Autopsy. Macroscopic examination of the cord showed a slight blue discoloration, one centimeter in length, between the sixth and seventh cervical segments; the discoloration was more marked on the ventral side. There was not the slightest indication either of extra- or intra-dural hemorrhage. A transverse section at the point of greatest injury showed hemorrhagic softening involving the whole area of the cord, excepting a small portion of the dorsal white tracts. Above this point, extending through four segments, was a tubular hemorrhage in the dorsal white matter, most marked in the third segment. Below the area of softening, there was considerable hemorrhage within the substance of the cord for a distance of several centimeters. Another tubular hemorrhage, similar in position and extent to the one in the upper cervical region, was traceable through the second, third and fourth thoracic segments. Microscopic examination verified the appearances as seen in gross. The gray and the white matter were not to be distinguished from each other; the myelin was in part stainable by the Weigert method but showed much evidence of disintegration. There was fresh hemorrhage throughout the cord but none whatever externally.

Diagnosis. This case illustrates a complete transverse

lesion of the cord, usually, as in this case, quickly fatal. The extent of the lesion beyond the main point of injury is important as showing the effects at a distance of violence to any one part of the central nervous system, and also as explanatory in certain cases of symptoms difficult to interpret by a single focal lesion. The futility of surgical interference in such cases of complete destruction of the cord is evident. The hemorrhage, as in this instance, is almost invariably within the substance of the cord, rather than subdural. Even if a subdural clot can be removed, the accompanying destruction of the cord renders the operation wholly inefficacious. Extreme pain or evidence of fractured laminæ justify exploration. Otherwise, in most cases of damage to the cord, operation should not be undertaken, first because it can accomplish nothing, and secondly because it leads to an added shock which is already great. This is especially true of lesions in the cervical region.

Prognosis. The outcome of destructive lesions in the cervical region of the cord is almost invariably fatal, for the reason that the nerves of respiration are involved, particularly the phrenic to the diaphragm, derived from the mid-cervical region.

Treatment. Treatment is in general unavailing. (See remarks under Diagnosis.)

Case 47. R. was admitted to a hospital, September 2, 1896, at the age of forty-nine. Her family and previous history have no bearing on the present situation. The story, although apparently contradictory in certain respects, is essentially as follows:

In July, 1894, she caught her foot in her skirt, as she was going up some steps, and was thrown violently backward on her spine, striking on the lower portion, and being unconscious for a half-hour. On recovering consciousness, she found herself paralyzed, both in arms and legs. She was taken to a hospital, where an operation was suggested, but declined. Recovery of the upper extremities took place gradually, but the legs remained paralyzed, both as regards sensation and motion, together with paralysis of the bladder and rectum. This latter condition continued for about two months, and then gradually improved. In two or three weeks after the accident, the sensation began to return in the right hand and arm; then in the left, but for a long time incompletely. There was also gradual improvement in the movement of the left lower extremity, but disturbance of sensation persisted. It was at once noted that sensation was preserved in the right lower extremity, but that the loss of motion was there practically complete. A note made September 2, 1896, states that the right arm had perfect sensation and motion; that the bladder function was still disturbed, but that the general condition of the patient was good.

Physical examination, February 1, 1897, was as follows: Except for slight irregularity of the pupils, the eyes were normal. Other cranial nerves were not affected. Movements of both arms were unimpaired and without alteration in reflexes. Abdominal and epigastric reflexes were lacking. There was a minimum amount of movement in the various joints of the right leg, with increased knee jerks. The improvement since the accident, both as regards general condition and special paralyses, was very definite.

On May 2, 1899, the patient was in essentially the same condition, except that she had regained complete use of her body and arms. She had, however, not been able to walk, and the paralysis of the right leg has remained essentially

unchanged. Lancinating pains in the sciatic region of both legs, which had previously been an annoyance, had gradually disappeared. The loss of sensation in the left leg was definite at this time, as it has remained since. There was still some incontinence of urine.

The patient was examined at various times during the ten or more years of her stay at the hospital, with essentially the same result. Beyond considerable adiposity, she showed no abnormality outside of the nervous system. The last thorough examination was made on the 22d of December, 1905, and gave the following results:

Motion, legs and feet: Right, active movements impossible at knee ankle and toes, beyond a possible very slight flexion of the toes. On the left, movements at knee, ankle and toes perfectly normal, and with excellent strength. The right knee jerk extremely active; the left very much less so. Ankle clonus distinctly brought out on both sides, but stronger and more persistent on the right. The Babinski sign definitely present on both sides, but more easily elicited on the right. The Achilles reflex not definite on either side. Front tap, both right and left, produced slight flexion of the great toes. There were no spastic contractures. All passive movements possible in both legs, although the right leg was slightly rigid.

Sensation: Pin prick felt much more sharply on the right foot and leg than on the left, with essentially normal motion. On the left, the sensation was described as "numb," a description which applies to the whole left leg. The temperature tests on the right leg were invariably correctly interpreted. On the left it was impossible for the patient to differentiate between heat and cold. Simple contact was felt about equally on both legs, absorbent cotton being used for the test. The same condition existed well up on to the trunk. No abdominal reflexes were obtainable. The patient stated that she felt objects somewhat better in the right hand than in the left, which was apparently the fact. The arm reflexes and strength of the arms were unimpaired, and the cranial nerves showed no abnormality.

Diagnosis. An autopsy was not obtainable in this case, but

the symptoms and the signs clearly show that the patient suffered a partial destruction of the cord, particularly limited to one side, presumably due to hemorrhage or softening in the thoracic region. In favor of this hypothesis is the fact that she had a paralysis of the lower extremities of the Brown-Séquard type, — namely, paralysis of motion more marked on one side and paralysis of sensation more marked on the other, with a preservation of the sense of contact. The explanation of this symptom-complex is found in the crossing of the various fibers subserving motion and sensation in its several forms as illustrated by the accompanying diagram.

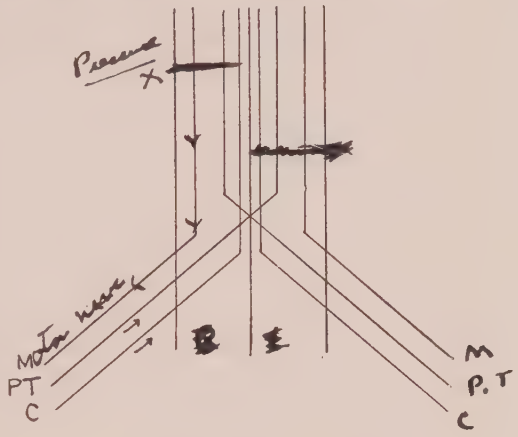


FIG. 19. CASE 47.

M, motility, uncrossed; PT, pain and temperature, crossed; C, contact, presumably partially crossed, here represented as uncrossed. A hemisection of the cord at X will therefore lead to paralysis of motion in the same side, and to loss of pain and temperature sense on the opposite side. Sense of contact and joint sensibility is lost in a measure at least on the same side as the lesion. The symptom-complex is rarely completely developed.

Prognosis. The patient lived for many years with relatively small discomfort, except for the fact that she was very stout and locomotion was impossible. Death finally resulted from intercurrent disease.

Treatment. Surgical intervention shortly after the onset of the paralysis was refused by the patient, no doubt wisely, as the event proved. At first she improved rapidly and later more slowly, but it is not probable that an operation could in any way have hastened this process. She was nursed with care, but beyond this her treatment was merely symptomatic.

Case 48. I., age thirty-five, a laborer, was admitted to a hospital, December 8, 1898. There was nothing in the family history bearing on his present condition. He remembered no previous illness of significance beyond the fact that he was at one time overcome by the heat while at work in a foundry. He had no obtainable venereal history, and was moderate in the use of alcohol and tobacco.

October 7, 1888, he fell eighteen feet from a wharf, striking on his back in about one foot of water. He was able to get on his feet and walk out of the water to a considerable distance, when he fell on his knees. From that time on he had practically no use of his legs. He remained in bed for several days unable to move his legs and with incontinence of urine and feces. He also lost sensation in his legs at this time. He had incontinence of urine and partial incontinence of feces, and complained of severe dull pain through his back. There was no improvement in motion or sensation. He had a feeling of constriction about his body. After a certain amount of general improvement, at the end of about eight months he was transferred to a hospital for chronic disease, where he remained for seven years. During this period sensation in the legs returned, so that he was able to recognize touch; the pain in the back also improved, and he was finally able to get about on crutches. While in the hospital he had two illnesses of unknown character, during which he fell off very materially in weight.

Physical examination on January 6, 1899, showed movement at the hip and knees possible but weaker than normal. Movements of the toes were also possible but weak. The knee jerks were increased but there was no clonus on either side. The plantar reflexes were present; the cremaster, abdominal and epigastric reflexes lacking. Examination of sensation at this time showed areas of partial anesthesia and hyperesthesia from about the seventh thoracic segment downward. The patient died May 12, 1899, without material change in his condition.

The **autopsy** showed, external to the cord, a mass of highly organized tissue, presumably the ultimate outcome of a very old blood clot. The cord itself was damaged practically

beyond recognition, although the symptoms even up to the end of the patient's life showed the possibility of a certain amount of conduction.

Diagnosis. The striking feature of this case lies in the fact that after the fall the patient was able to get to his feet and walk a considerable distance before falling with a rapidly supervening complete paralysis of the legs. This unusual history suggests the possibility of a Hemorrhage which did not at once attain sufficient extent to destroy the cord. The analogy to the period of consciousness following meningeal hemorrhage is striking and suggestive.

Prognosis. The patient lived eleven years, a large part of that time being spent in hospitals. He was never useful during this long period, but at one time was able to get about to some extent with a skilfully devised apparatus; he was also able to use crutches.

Treatment. In this case it is probable, had an exploratory laparotomy been done at once, that a very considerable relief might have been secured. Hemorrhage extra- or sub-dural is, however, in these cases so unusual an occurrence that immediate surgery is usually not demanded.

Case 49. E. was referred by an ophthalmologist for a slight twitching of the face muscles, flushing of the left side of the face and tingling sensations in the tongue on the right side. The eyes were reported by him normal, except for fibrillary twitching of the lower left lid. The pupils were normal, as were the muscle balance, vision and the fundus. She was twenty-five years old, unmarried, and was leading a somewhat arduous life as a nurse. She was first seen December 11, 1909, with the complaint that for five or six weeks she had noticed twitching of the muscles under the left eye, which she thought was extending somewhat to the muscles below the mouth. She had much cause for anxiety apart from her work; her sleep had been interrupted; she felt herself tired. Her appetite, bowel action and menstruation were normal. She was under the impression that the twitching was more marked when she was tired and overworked. Physical examination showed no abnormality beyond the twitching movements already referred to and a possible slight left facial paresis. She was somewhat emotional, for which there seemed adequate cause. There was no sufficient evidence to indicate a structural disease of the nervous system.

She was again seen one year later. She had given up her work and had had many symptoms, among them brief attacks of deafness, marked speech disorder, slight Jacksonian attacks, facial paralysis. None of these were persistent. Vision had constantly and steadily failed to the point that she was able to see very little distinctly, although still able to count fingers if brought near her eyes.

Examination showed the following conditions. Pupils wide, imperfect light response, better on the right than on the left; no well-defined nystagmus. The optic disks were very pale in both eyes but without marked alteration of the vessels. There was no definite pallor of the temporal halves of the disks as compared with the nasal. Hearing (Rinné test) normal in both ears; tongue protruded straight without definite tremor; other cranial nerves normal with the possible exception of a slight facial palsy to which allusion has already been made. The arm reflexes were all active; objective sensation was somewhat blunted, especially in the right hand;

there was an extreme degree of ataxic tremor of the right arm and hand, less marked on the left. The knee jerks were very active; Achilles obtained on both sides; Babinski marked on the left, strongly indicated on the right; ankle clonus suggested but not definitely obtained on both sides; objective sensation of the feet was well preserved but with distinct loss of sense of position of the toes. She was unable to walk. While sitting in her chair there was absolutely no tremor; on attempted movement, extreme ataxia developed, particularly in the right arm, to the extent that it was impossible for her to feed herself or do anything definite with the hand. There was also considerable tremor of the head and of the legs, when moved. Her speech was distinctly scanning in type, but was said at times to have been worse than at this examination. There was no definite history of forced laughter or weeping; mentally she was clear but showed considerable euphoria; her manner was decidedly more cheerful than at the examination a year previously, before definite symptoms had developed. The heart was normal; blood pressure 110, and pulse of normal rate and rhythm.

Diagnosis. This is undoubtedly a case of Multiple (disseminated) Sclerosis. The signs of tremor of the intention type, scanning speech, sense of well-being, abnormally active deep reflexes, together with the transient character of many of the symptoms, and progressive atrophy of the optic nerves render this diagnosis certain. The chief interest of the case lies in the fact that, only one year before, none of these signs was evident and no other diagnosis at that time appeared justified than facial spasm on the basis of general nervous exhaustion.

Prognosis. The extreme rapidity of the development of serious symptoms renders the outlook for life doubtful. It is not probable that the patient will live more than two years. It should, however, be remembered that long remissions of symptoms are frequent, if not characteristic, in this disease. Complete blindness is sure to supervene in a relatively short time.

Treatment. The treatment is palliative merely.

Case 50. S., thirty-six years old, widow, born in Ireland, was admitted to a hospital December 5, 1898. The family history was not important. The patient had always been well; she had had two children, both healthy, but who have since died, and one miscarriage said to have been the result of falling downstairs. She denied venereal disease and gave no definite history of infectious disease; she had taken alcohol in excess, chiefly beer. About a year before entrance to the hospital she noticed an increasing weakness of the legs; also unusual " motor nervousness "; she was told by a friend that her face did not look natural, which she verified by looking into the mirror and finding that her face was drawn to one side; she had had no pain and did not know of this change until told. In two weeks her symptoms had entirely disappeared, and they did not return until eight months previous to her admission, when she says that she caught cold; her right arm and leg became weaker, and she found she could not do her work satisfactorily, which was waiting on table.

Notes made during the following months show that the reflexes were increased; that she had the Babinski sign; that there was slight nystagmus of both eyes; that her speech was slow and scanning; that there was much spasticity of the lower extremities, but without definite disorder of sensibility. A year later she had increasing difficulty in walking and often fell; tremor of hands at times prevented her from grasping a support, and she gradually became confined to her chair. Beyond the general symptoms noted, she was well; her appetite was good; bowels regular, sleep satisfactory, and she made no complaints.

October 30, 1901, she was unable to feed herself with her right hand because of tremor, but she could use her left. Careful examination at this time showed no disorder of sensibility.

A detailed examination made July 10, 1902, was as follows: As the patient sat in a chair with head resting, there was practically no tremor either of head or extremities; on raising the head a marked tremor, coarse in character, was apparent. The patient naturally sat with her head supported; on at-

tempting to make any intended movement a very marked tremor manifested itself, very much more pronounced on the right side than on the left; this tremor affected not only the arm in use but also the entire body and head; for example, an attempt to button a large button with the left hand was accomplished with difficulty and considerable tremor; the same action with the right hand was absolutely impossible, owing to the increasing violence of the tremor; an attempt to write, even with the left hand, was entirely impossible, the whole body being thrown into a violent tremor. An effort to make definite movements with the legs while in a sitting position was carried out with apparent weakness and very imperfectly, owing to the tremor; it was also impossible for her to stand alone; the attempt to rise from a sitting posture with support was effected only with a violent exacerbation of the tremor. The patient did not walk or attempt to get about without assistance. The speech was of a perfectly typical scanning character. There was no oscillation of the eyes on direct fixation in a straight line; on attempting to follow the finger to one or the other side a marked oscillation developed, with inability to fix the eyes for any length of time; the pupils were equal in size. There was slight asymmetry of the face, but no paralysis of any of the cranial nerves. Watch tick was heard better on the right than on the left; on the right at a distance of about two feet, on the left, three or four inches, approximately. Muscles were well formed and sufficiently voluminous, with no evidence whatever of atrophy; except for the tremor, the active and passive movements of the arms were free, and the hand grasp on both sides was of a fair degree of strength; there was no paralysis of the legs, the movements being effected with slight appearance of weakness, but otherwise normally, apart from the tremor. The knee jerks were much increased and there was marked ankle clonus on both sides; also definite Babinski on both sides; abdominal and epigastric reflexes absent; slight increase in deep reflexes of the arms. Light touch and pin prick felt apparently over the body and limbs; patient made no complaint of numbness, pain or other disturbance of sensation.

The heart and lungs were normal. The bowels were regular; appetite good and sleep undisturbed; no disturbance of micturition. The mental state on the whole was normal, but the patient possibly showed some defect in memory and a slightly abnormal sense of well-being.

August 6, 1902, the condition was not much changed; she suffered no pain, but was heavily handicapped by tremor, since she could not comb her hair, feed herself, or even pick up anything without great difficulty. She was barely able to raise herself from her chair.

Examination, April 9, 1903, was as follows: Feet very cold and somewhat cyanotic; ankle clonus on both sides; very active Achilles reflex on both sides, which throws the feet into clonus; front tap on the left very marked, absent on the right; Babinski reflex by the ordinary test not obtained, but by stroking the anterior portion of the sole of the foot at the base of the toes, typical Babinski phenomenon resulted. There was practically complete loss of sense of position in toes; pain sense somewhat diminished over the feet; sense of contact preserved, although answers to questions concerning sensation were sometimes uncertain; there was marked disturbance of sense of position in the hands; no individual tremor of the head except when held in a fixed position; no cranial nerve palsies; difficult fixation of eyes.

Since the foregoing examination there was a constant gradual failure up to the time of her death, with an increase in all symptoms; speech became scarcely intelligible; tremor remained very much greater on the right than on the left; movements of any sort were practically impossible on account of the violence of the muscular movement; there was a somewhat definite tendency toward mental failure, but the sense of well-being continued; there were no complaints whatever of pain; exact determinations of sensory disturbance became difficult owing to the mental state of the patient. The urine showed no significant abnormality. Examination of the eyes showed no central color scotoma; normal fields of vision somewhat reduced; the disk showed pallor of the temporal side; fundus otherwise normal. She died March 20, 1904, after an illness of about five years.

Autopsy. The autopsy revealed widely extended areas of sclerosis throughout the entire spinal cord and brain. Microscopic examination of these areas showed the characteristic loss of myelin with less completely destroyed axones, the whole central nervous system presenting a perfectly typical picture of a very widespread multiple sclerosis.

FIG. 20. CASE 50.

Section through pons, showing areas of sclerosis (shaded).

Diagnosis. This case at first simulated a systemic cord lesion with a spastic paraplegia as the predominant sign. Later, tremor or, better described, ataxia of the intention type, nystagmus and a characteristic scanning speech defect developed, rendering the diagnosis of Multiple Sclerosis absolutely certain. At no time after the very earliest stages was the diagnosis in doubt.

Prognosis. The patient lived about five years, about an average period of life in this disease, although it undoubtedly may in some instances run a much quicker course and in others be extended over a much longer period with long remissions of symptoms. It has in fact been maintained that certain cases recover, but this must be regarded with extreme doubt.

Treatment. In the present state of our knowledge the treatment is merely palliative. There are no methods at our disposal of combating the progress of the sclerosis.

Case 51. N., seventeen years old, was first seen August 13, 1909. Her attention had first been called to her condition on putting her feet into a hot bath. She noticed nothing unusual in the left leg but on putting the right in the water, the heat was so extreme that she was obliged to withdraw it immediately. Her attention having been called to the matter, she thereafter noticed that she could not recognize differences in temperature over the whole left leg. Her general health had been good; there was no tuberculosis in her family; she had had scarlet fever when a child and other children's diseases, but nothing bearing on the present situation. In 1900 adenoids had been removed. She was an unusually well-developed girl, with an appearance of perfect health.

Examination revealed no abnormality whatever with the cranial nerves, arms, heart or other thoracic organs. The left leg showed a complete anesthesia to temperature, extending both front and back over the entire extremity and up to about the level of the umbilicus. The same area was also insensitive to painful stimuli. In spite of this fact, contact of the most delicate sort was readily recognized over the entire area. This dissociation of sensation was perfectly definite. All motions of the leg were possible, although perhaps slightly restricted in the toes of the affected foot. There was no muscular atrophy and no fibrillation. The knee jerks were active on both sides but rather more so on the right. There was no Babinski sign; no clonus; the Achilles reflex was somewhat more active on the right than on the left. She had noticed for some time a tendency to lose the great toe nail on the left foot without adequate cause. This had happened twice but was not a constant difficulty. There was also an area of scleroderma on the upper inner side of the left thigh which was persistent. There was no curvature of the spine, no pain on pressure over the nerves, the muscular development of both legs was excellent and equal on the two sides. There was no involvement whatever of the bladder or rectum. At times, there was a possible slight limp, but this was not constant. Examined a year and a half later, the condition was practically unchanged. No atrophy had developed; the sphinc-

ters were still uninvolved; the trophic disturbances in the toenail were somewhat improved; the general areas of disturbed sensibility and the dissociation were as before. The right leg was, and has remained, entirely uninvolved.

Diagnosis. So marked a dissociation of sensation as here observed leads to the supposition that the lesion producing it lies within the substance of the cord in its dorsal portion involving the fibers which subserve pain and temperature (crossed) and sparing those which subserve contact, for the most part uncrossed and occupying the dorsal columns of the cord. (See Case 48, also Fig. 4.) The usual lesion causing this disturbance is a gliosis or Syringomyelia. It is evident that a lesion lying external to the cord would involve all forms of sensibility. The dissociation in the absence of definite injury through trauma (Case 48) is therefore the deciding factor in diagnosis. In later stages, as the gliosis spreads, the ventral horns are apt to be invaded, leading to a characteristic muscular atrophy. The usual exaggeration of the deep reflexes in the legs (not observed in this case) is brought about by pressure upon or partial destruction of the pyramidal tracts above. Trophic disorder, in this case loss of the toenail, is a common accompaniment of the disease. The unusual features of the case are the sharp localization to one leg, the lack of muscular atrophy and the apparently stationary character of the process. The common site of the lesion is in the cervical region, the cavity formation extending a varying distance up and down the cord; the lumbar region is much less frequently involved. The differential diagnosis from progressive muscular atrophy of the spinal type lies in the fact that there is no sensory disorder in an uncomplicated muscular atrophy. The differential diagnosis from

FIG. 21.

From a case of syringomyelia; lumbar region, showing cavity formation in dorsal columns and degeneration of pyramidal tracts.

multiple neuritis is often difficult and must be made from the lack of dissociation of sensation in neuritis, from pain on pressure over the nerve trunks in the latter condition and from the general difference of distribution of the two processes. Syringomyelia usually manifests itself by atrophy and dissociated sensation in the upper extremities with spasticity in the lower, but without spontaneous pain or pain on pressure over nerve trunks. This grouping of symptoms does not occur in neuritis. The history given above is not a typical picture of syringomyelia, but the perfectly defined loss of perception of pain and temperature, with retained sense of contact, permits of no other diagnosis in spite of the lack of other signs, which as the disease progresses will no doubt develop.

Prognosis. The location of the process in the lumbar region and its evident extremely slow development render the outlook for life good. Trophic conditions in the anesthetic parts are likely to be a constant source of annoyance and possible danger.

Treatment. No means has as yet been found to check the progress of the gliosis.

Case 52. E., a man thirty-three years old, unmarried, by occupation an amalgamated gold miller, was first admitted to a hospital February 12, 1903. He was discharged and readmitted, January 1, 1904, for the treatment of trophic ulcers and asthma.

The family history had no bearing on the condition. The matter of chief interest in the personal history was the presence of a sacral spina bifida, from which his disabilities, excepting his asthma, came. On several occasions he had had cystitis. He had always had incontinence of urine and wore a urinal constantly. His bowels moved irregularly, and coughing was apt to force out a small amount of feces; if the desire for defecation was not soon gratified, he occasionally had incontinence. This had remained unchanged throughout his life. Five years before entrance to the hospital, he was treated for three months for an ulcer on the right side of the right foot at the base of the little toe, with necrosis of bone. The ulcer finally healed. Four years later a similar condition appeared on the left foot, for which he was again treated with final healing. He was again admitted to the hospital with a recurrence and necrosis of bone. He had always noticed diminution of sensation over and above the tumor caused by the spina bifida and in the legs and feet. Except when struck, the spinal defect had itself caused him no trouble. On those occasions, however, when it had accidentally been struck, he said " he dropped like a shot " and had a tonic convulsion depending upon the severity of the blow. He made the statement that " he was once paralyzed for three days as a result of a hard blow received there, and was in agony from a feeling of pins and needles over his legs." Except for the awkwardness due to deformity of his feet, he was perfectly able to walk, and he maintained that his sexual capacity was unimpaired. He had had no venereal disease, had been very moderate in the use of alcohol and tobacco and had been able to learn and successfully apply a trade requiring physical effort and manual dexterity. In spite of urinary and fecal incontinence, his companions had not recognized his disabilities.

Physical examination gave the following results: Well-

developed man, with no obvious signs of disability except the easily noticeable deformity of the feet. Tongue, chest, — except at times for asthmatic râles, — heart, abdomen and abdominal organs normal. Directly over the sacrum was a hard, doubtfully fluctuant, round tumor, $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inches in diameter, the upper level being $1\frac{1}{2}$ inches below the posterior superior spine of the ilium, and the lower between two and three inches above the anus. Pressure over the tumor produced pain. Gentle touch over the tumor was not felt; pin prick very slightly felt as touch (pressure?); outer side of left foot cooler

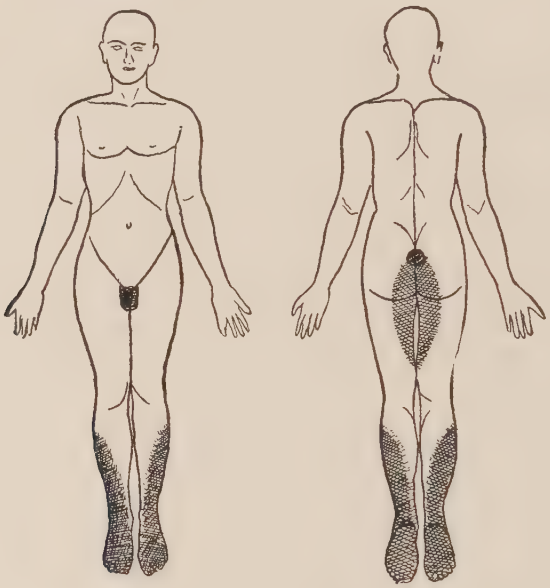


FIG. 22. CASE 52. Areas of Anesthesia shaded.

than inner; loss of muscle sense in toes; legs, in general, cold, cyanotic and more or less discolored; tremor of thigh muscles (excitement?); knee jerks normal, no ankle clonus; plantar present; no front tap; no Achilles; no cremasteric; abdominal and epigastric reflexes, also, not obtained. The feet both showed marked clubbing, which was apparently gradually increasing, interfering considerably with walking. There was slight Romberg, due, he thought, to the deformity of the feet. There was a scar on the under surface of the right

foot, at the tarso-metatarsal joint. On the left foot, a sinus over the fifth metatarsal joint extended upwards about an inch and a half; the bone was necrotic; moderate purulent discharge; considerable swelling of the foot, expecially of the dorsum, with some induration. There were also slight excoriations in both gluteal folds. Except for the limitation of motion dependent necessarily upon the deformity of the feet, no motor paralysis was discoverable. Flexion at the ankle and movements of the toes were possible, though naturally imperfect. Movements at the knees and hip were perfectly free and made with good strength. There was protrusion of the anus. The sensory loss was as indicated in the diagrams. The areas deeply shaded were practically completely anesthetic, but the anesthesia everywhere faded out at the borders into the normal.

Treatment at the hospital resulted in a final healing of the foot ulcer, in an amelioration of the asthmatic condition, and he was discharged. A recurrence of ulceration in both feet led to his return a few months later. In general, the condition remained unchanged, excepting, as he thought, for an increase of the club-foot deformity; at a recent examination, also, the plantar reflex was reported as absent, instead of present as before noted. The patient remained physically well; the ulcers and club feet combined interfered with walking, which was otherwise perfectly possible, and his scrupulous care had prevented the complications likely to result from urinary incontinence. He has not been seen for several years, and the final outcome of his difficulty is not known.

Diagnosis. The diagnosis of this condition presents no difficulties, since the deformity resulting from the imperfect closure of the spinal canal is apparent.

Prognosis. The prognosis of spina bifida in general depends upon the degree of destruction of the cord and the consequent amount of sensory disorder. Bedsores or other trophic disturbances are extremely likely to occur. In this case, the extraordinary care taken by the patient had absolutely obviated this danger. The slightest carelessness, however, would have led to a rapidly fatal outcome. Cystitis is a danger which again by scrupulous cleanliness was avoided.

Treatment. Cleanliness and care of the skin is the first requisite in treatment. Surgical interference was not possible.

NOTE. The points of practical importance which a study of this case illustrates are, — the distribution of the areas of anesthesia from lesion of sacral nerve roots; the retention of sexual capacity in spite of extensive destruction of the sacral nerve roots; the absence of marked disturbance of gait in spite of plantar anesthesia; the practical possibility of physical cleanliness with both vesical and rectal incontinence.

Case 53. U., a married woman of twenty-one, was first seen December 18, 1909, complaining of weakness of the legs and back and incontinence of urine. She walked with the greatest possible difficulty and with decided spasticity. Her history, in general, was that previous to marriage she had given birth to a stillborn child. After marriage, incident to the birth of her second child, five weeks before, she had entered a hospital for pelvic disorder. She was in poor general condition at that time, and had been suffering from chronic laryngitis. Examination showed a subinvolution of the uterus with abdominal tenderness. This was operated upon with success. The urine was negative. When examined, December 18, she made no complaint of pain, headache or vomiting. The pupils were normal and the arms showed no involvement. The legs were both weak and extremely spastic, the right more so than the left. The knee jerks were greatly exaggerated and ankle clonus and Babinski sign were easily obtained on the right, but neither could be elicited on the left. There was also difficulty with the control of the sphincters, but sensation in general was essentially unimpaired.

After a stay of several weeks in the hospital, she improved considerably and at the time of leaving was able to walk with some comfort, although she was still spastic. While in the hospital a Wassermann test was positive. She was given large doses of iodide of potash and mercury by inunction with the result that there was a gradual but definite improvement. The urine showed some pus; examination of the stools gave no information of consequence. After leaving the hospital, treatment was continued with much constancy. On November 19, 1910, examination showed considerable stiffness of the legs, active knee jerks, the right slightly greater than the left, a more active Achilles on the right, with clonus and Babinski as before. Sensibility, as tested by contact, prick and temperature, was unimpaired, except for a patch on the outer side of the right thigh, where all forms of sensibility were lost or diminished, with a subjective feeling of heat in that area. In general the patient had greatly improved, was able to do her housework but continued to have, when last seen, exacerbations of symptoms from time to time.

Diagnosis. The diagnosis in this case is undoubtedly a Syphilitic Meningo-myelitis of the dorso-lumbar cord, described by Erb as Syphilitic Spinal Paralysis. This lesion is characterized by a localization of the syphilitic process at the lower portion of the cord, beginning in the meninges and invading the cord to a greater or less degree. The process occurs with sufficient frequency to justify a special designation, although it is evident that it is merely one of the many possible manifestations of syphilis of the central nervous system. The diagnosis is made by the etiology, and a type of cord invasion characterized by marked and early spasticity (invasion of the pyramidal tracts) with less conspicuous disturbance of sensation and of sphincter control.

Prognosis. The prognosis is good, provided the affection be recognized in its earlier stages and vigorously treated. In this case, it is clear that the cord has been so far damaged that its complete restoration is impossible. Improvement has taken place, but not cure.

Treatment. The treatment is by vigorous and persistent use of iodide of potash in dosage up to 150 grains a day, and mercury, best given by inunction or by subcutaneous injection. In this case iodide and mercury by inunction have been administered over a period of more than a year with satisfactory but not brilliant results. The process may, however, be held in check if not completely relieved. To this end, anti-syphilitic treatment should be indefinitely continued with certain remissions. Salvarsan is of doubtful utility in these cases, so far as our present knowledge goes.

Case 54. R., forty-five years old, was admitted to a hospital, April 16, 1895. He had had typhoid fever the preceding summer, and shortly after recovery noticed a lump about the middle of his back, which was not painful. He soon experienced some difficulty in walking; under orthopedic treatment the lump decreased considerably in size. The patient denied venereal infection, and in general had been well antecedent to the attack of typhoid fever mentioned. When again admitted to the hospital he was unable to walk and complained of numbness of the legs from the knees down. He also had some difficulty in micturition, but no incontinence. There was at no time any cerebral disturbance.

Physical examination at this time showed the arms uninvolved; passive movement in both hips slightly hindered; stiffness and rigidity of both legs, particularly of the right; ankles rigid; active movement impaired in all directions; no ataxia; feet in position of marked plantar flexion; knee jerks on both sides very much increased, with patellar clonus; ankle clonus strongly indicated on both sides; Babinski on both sides; cremaster present, slight; abdominal and epigastric reflexes normal. Sensibility to pin prick was at this time unimpaired; contact was also normal and there was no loss of sense of position in the toes.

From that time on the symptoms already noted increased steadily in spite of such treatment as was applied, the kyphosis varying in size, dependent largely upon whether the patient attempted to sit up, when it at once increased. The spastic rigidity of the legs increased to practically complete paraplegia with highly exaggerated reflexes, but without marked objective disorder of sensibility. Subjective sensations of numbness were, however, well marked; difficulty in micturition persisted, and he had at times painful sensations in the epigastrium when he attempted to sit up. Contractures of the feet became very marked, and slight but definite disorders of sensation finally came on in the legs; the prick of a pin could no longer be recognized as such. This condition remained fairly constant, but on the whole there was a steady increase in the signs of injury to the cord. Even under these discouraging conditions decided temporary improvement

took place through manipulations of the legs and through wearing a leather jacket. The back became straight, somewhat rigid, without kyphosis, and he was able to walk with crutches, swinging the legs from the hips. From this time on until his death in February, 1902, he remained essentially the same, death finally resulting from extension of the tuberculous process and amyloid degeneration.

Examination of the spine showed a complete tuberculous disintegration of the body of the eleventh thoracic vertebra

FIG. 23. CASE 54.
Levels of the cord showing degeneration.

with a constriction and partial destruction of the cord at that level, brought about in great measure by the effects of extradural pressure. The appearance of the cord is shown in the accompanying figure.

Diagnosis. Tuberculosis of the spine is much less frequent in the adult than in the child. The appearance of a kyphos, however, with accompanying signs of cord involvement, should always lead to the suspicion of a tuberculous process. Carcinoma of the vertebræ may at times closely simulate

Pott's disease, but is usually accompanied with more pain. Search also is likely to reveal the primary tumor in breast, stomach or uterus.

Prognosis. Pott's disease is not in itself a fatal disease, and if properly treated early in its development should lead to no marked deformity or involvement of the cord. In this case treatment was not begun soon enough, and in any event the dissemination of the tuberculous process to other organs could not have been prevented.

Treatment. The treatment is sufficiently indicated in the foregoing history.

Case 55. O., a married woman of sixty-three, was seen August 28, 1902. The history she gave was that apart from rheumatism and two miscarriages she had been, in general, well, but that in April, 1902, she had had pain in her back at about the level of the lower rib border. She was obliged to take to her bed in June with increasing weakness of the legs, so that finally she was unable to stand without support. The legs also felt numb and there were " prickly " sensations. There had been no difficulty with micturition. A few days before being seen, she had somewhat suddenly lost practically all power in the legs, and the pain about her body, sharply localized at about the level of the umbilicus, had increased in intensity. Further examination showed a scirrhus cancer of the right breast in its upper outer quadrant with retraction of the nipple and extreme involvement of the axillary glands. Difficulty in urination also developed with the general increase of the cord symptoms.

Physical examination showed a general, marked blunting of sensation to pain and contact in the legs, extending up to about the level of the umbilicus. Associated with this was marked weakness of the legs. The knee jerks were extremely active; there was double ankle clonus, but questionable Babinski. The pupils were normal, the heart showed no abnormality and mentally the patient was clear. The hemoglobin was 100%. She died about a month after being seen, after having lost all use of her legs. For ten days before her death, she was in semi-comatose condition.

Diagnosis. It is evident that this patient had a metastatic carcinomatous infiltration of the spinal cord at the level of about the tenth thoracic vertebra, consequent and directly derived from a pre-existent carcinoma of the breast. In this case, the cord suffered a practically transverse lesion, characterized by disturbances of motion, sensation and sphincter control below the point of the lesion. It is of interest that the lesion of the cord lay considerably below the original focus. It is more usual that secondary involvements of the cord from breast cancer affect the cervical or upper thoracic region, whereas metastases from the uterus are likely to involve the lower cord, and from the stomach the mid-thoracic

region. Cord symptoms developing in the presence of carcinoma elsewhere should always give rise to a suspicion of metastases; and conversely signs of cord tumor, particularly in elderly persons, should lead to a suspicion and a consequent investigation as to the existence of tumor in other parts of the body.

Prognosis. Carcinoma involving the vertebræ and cord is almost invariably metastatic, and is in all cases a fatal disease.

Treatment. Operative treatment in this case was considered, but not carried out in view of the wide invasion of the cancer in other tissues, as well as in the cord. The use of morphine to relieve the pain in these cases, which is often excruciating in character, is wholly justified, both by the immediate suffering and the inevitably fatal outcome.

Case 56. L., an unmarried woman of twenty-seven, was first seen early in October, 1904. She had had malaria five or six years previously, following which what were supposed to be glands appeared in the neck, which have persisted. These were somewhat tender on pressure. For four or five years she had not, in general, been well, and there was complaint of fatigue on exertion. Two years previously, she had noticed sweating of the right side of the face and falling of the right eyelid. She thought at that time that her vision was impaired; there was no diplopia. In January, 1904, a feeling of stiffness developed in the right leg and she also had "rheumatism" of the left knee and foot. There was no sharp pain, and what headaches she had she thought depended on the use of her eyes. For six or eight months there had been numbness of the right foot, less of the leg. There had likewise been, while confined to her bed, some urinary disorder, probably incontinence.

Physical examination in October showed markedly unequal pupils, the left being about three times as large as the right; both reacted to light; the accommodation was normal and there was no hemianopsia. There was no paralysis of the ocular nerves or of the other cranial nerves. The hands were free from ataxia and normal in strength, and sensation was, in general, unimpaired. Both knee jerks were markedly exaggerated, the right more than the left. There was a strong tendency to ankle clonus on the right with a Babinski reflex. There was neither plantar nor Babinski on the left. Achilles was present on both sides. The right foot and leg were much cooler than the left, with some probable loss of sense of position of the toes, especially on the right. There were several hard swellings of the size of large glands in the neck and above the axillæ, some of which were sensitive on pressure. There was a similar tumor in the left groin; no glands were felt at the elbows. These swellings she thought had remained about the same for a period of five or six years.

Administration of iodide of potash accomplished nothing, nor did massage help the situation. She continually grew worse, fell more easily than before, was restless at night; some rectal incontinence developed, together with the urinary

difficulty; she had sensations of throbbing and burning in the right leg, together with some sharp pain down the leg and in the back and left side. By December, walking had become practically impossible, there was marked spasmodic contraction of the legs, especially on the right, and flexion at the knee and hip with abduction at the thigh. Sensation in the feet became blunted. Ataxia of the arms did not develop. The blood showed hemoglobin between 80 and 90%. More pain developed in the right arm and both legs, with persistent contractures. She was evidently rapidly growing worse.

The patient, eight months later, passed into the hands of a colleague who diagnosticated multiple tumors, one or more of which were invading the cord. During the interval, she had completely lost the power of walking and all control of the sphincters. The sensory disorders of the legs had increased and atrophy, particularly of the right hand, had developed. Sweating and flushing had extended over one entire side of the body and anesthesia had developed to a point about midway between the umbilicus and the breasts, together with disturbance in the ulnar distribution on both sides. At that time, the patient stated that she had been free from pain from the beginning of the trouble. A portion of the tumor removed from the right thigh showed it to be a fibrosarcoma. Two operations were done in which the cord was exposed at the level of the fifth, sixth, seventh cervical and first thoracic vertebræ. An extradural tumor was found adherent to the fifth cervical vertebra about the size of an olive stone, which had flattened and compressed the cord, particularly on the right side and ventrally. Improvement began at once after the operation with a return of sensation in the legs, increased power of motion and recovery of control of the sphincters. The spasticity also improved and walking began to be possible. The eye condition became more normal. Her later improvement was very marked, but at the last report recovery had not entirely taken place.

Diagnosis. The original diagnosis in this case was incorrect. The spastic condition of the legs, together with sphincter disorder and some disturbance of sensation, in the absence of

any definite complaint of pain led to the supposition that the patient was suffering from a diffuse combined degeneration of the cord giving rise to an ataxic paraplegia. More importance should have been attached to the inequality of the deep reflexes on the two sides and especially to the narrowing of one palpebral fissure, inequality of the pupils and unilateral sweating, as indicative of a focal lesion. The presence of other tumors, mistaken for glands, should also have excited suspicion when the patient was first seen. An operation at that time would undoubtedly have resulted, so far as the spinal symptoms were concerned, in a practically complete cure. Too much stress was laid upon the absence of sharp, localizing pain. In the light of the subsequent history, and particularly when reviewed after the demonstration of the existence of a tumor by operation, it appears that the early diagnosis of diffuse lesion of the cord was entirely unwarranted. In partial justification of the early opinion, it may be said that the symptoms developed rapidly immediately before the operation and that the beginning involvement of the arms was particularly suggestive. The lesson of the case is, that even in the absence of localized pain in the distribution of the spinal segment involved, a diagnosis of tumor of the cord may still be made if the symptoms are somewhat unilateral in character and other signs point toward a focal lesion. A more careful examination of sensation in relation to the motor disability would have been desirable to determine definitely whether the significant Brown-Séquard complex existed at any period of the disease.

Prognosis. So far as known, the outcome of this case has been favorable. The danger lies not so much in further involvement of the central nervous system as in the growth and extension of the more peripheral tumors. It is unfortunate that the operation was not done earlier in the course of the disease; in that event, no doubt the spasticity which persisted to some degree would have been entirely obviated.

Treatment. Early operation is desirable in Cord Tumors before any considerable degree of pressure has been exerted upon the cord. Many of these tumors lie under the dura, as in this case, in such a position as to be easily removed.

Hence, their treatment by surgical means offers a very hopeful field. Drugs are unavailing except in cases of syphilitic lesion, when a vigorous use of iodide of potash and mercury often brings about very great improvement. The removal of laminæ leads to no permanent discomfort or weakness of the spinal column, and in skilled hands is an operation of no great difficulty.

Case 57. O., a woman twenty-four years old, married, noticed the first symptom of the disease from which she later died, September 25, 1905. She was at the time pregnant, but had not hitherto suffered more than the usual discomfort. On September 25, during the night, while traveling in a sleeping car, she was suddenly seized with pain radiating down both legs. The next day the pain and discomfort continued and on the whole increased in severity. During the following month, October, she had constant and excruciating pain. During this time she was unable to lie in bed, and slept propped with pillows, in a semi-erect position. Treatment by violet rays did not result in benefit. In spite of her discomfort she slept from four to five hours during the night, although often waked by pain. Her mind was perfectly clear. The first week in November there was apparent improvement, although she was never wholly free from pain. At this time, the condition was diagnosticated as neuritis. She was then suffering from extremely severe pain in the legs, coming on in attacks which lasted several hours. There was also complaint of pain in the back. Relaxation of the sacro-iliac ligaments was shown not to be the cause of her discomfort. On December 7, there was complaint of pain and stiffness of the legs, pain in the region of the bladder, and pressure in the rectum. The patient was extremely restless and much constipated, but obtained a fair amount of sleep. During the days immediately following there was much pain in the legs and back and a constant desire to sit up on account of the greater comfort while in that position. At times the pain in the back and legs would recur immediately on lying down. The urine was passed freely, but was under control. The restlessness, evidently induced by pain, was constant and distressing, necessitating very frequent changes of position, both in bed and out. At times the pain seemed to become unbearable, but frequently was alleviated by drugs other than morphine. Toward the middle of December, there was complaint of soreness in hips, legs and knees. She found relief in walking; micturition was frequent, but in spite of this fact she complained that the bladder "felt bursting." On December 22, there was for the first time some difficulty

in passing urine, with continuance of the complaint of pain in the bladder, at times described as "intense." Catheterization relieved this symptom for the time being and large amounts of urine were passed when the catheter was not used, but only after efforts lasting an hour or more. At about this time she became irrational at night. Excessive pain in the back and legs continued, and the legs and feet began to grow weak. On December 24, when out of bed, she was practically helpless, and could not support herself properly when standing. She was, however, still able to pass urine, although with much difficulty. On December 25, control of the feet and legs was practically lost, and there was complaint of numbness of the legs. In addition she had had hallucinations both of sight and hearing and occasional disorientation both as to time and place. She was not depressed, and questions were answered with absolute clearness.

Examination of the legs objectively showed that pain and contact were felt and correctly interpreted, although blunted over certain areas below the knee. Temperature was correctly recognized over both legs wherever tested. The muscular sensibility of the toes was unimpaired, but the soles were not ticklish. The motion of the toes and ankles was preserved and carried out with a fair degree of strength. Both flexion and extension of the knees, were, however, very much affected, and, in fact, very little movement was possible. The knee jerks were absent in spite of reënforcement. There was no plantar reflex, however; no clonus, and no Achilles reflex. The paralysis was flaccid. Headache, of which complaint was made, was somewhat vague in character and at this time wholly subordinate to the more intense pain of the lower back and legs. Mentally, she remained much disturbed, and the condition of the legs also grew progressively worse. Sensibility was more impaired and the disturbance extended upward, involving the thighs. Urinary incontinence became complete, and there was absolute loss of power in the legs and thighs on January 11. Except for slight retained sensation in the upper part of the thighs, the loss was complete. Slightly higher in the gluteal region and to a point about midway between the pubes and umbilicus,

there was marked hyperesthesia. Examination of the urine at this time was as follows: Twenty-four hour amount, 2,900 ccm.; sp. gr., 1,004; color, pale; reaction, acid. uph., —; ind., —; sulph., —; acetone, 0; urea, 23.999 gm.; uric acid, 0.17; chlor., 4.4; phos. a., 0.14; sugar, 0; albumin, slightest possible trace; uric acid to urea, 1 to 141. Sediment, occasional hyaline and granular casts with occasional squamous cells and leucocytes. Lead and arsenic both absent.

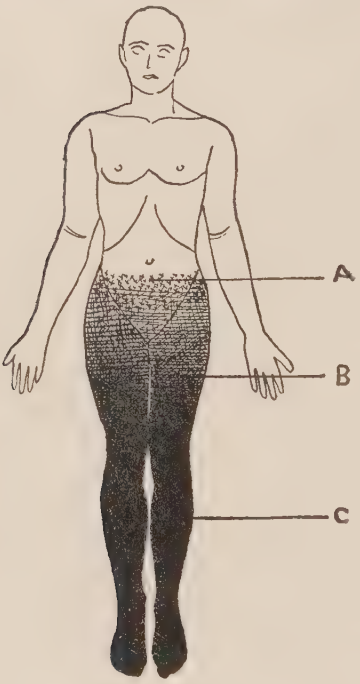


FIG. 24. CASE 57.

Areas of anesthesia and hyperesthesia, January 11, 1906. A, Hyperesthetic zone. B, Anesthesia almost complete. C, Complete anesthesia. Disorders of sensation occurring later in body and upper extremities not charted.

Later, stiffness of the neck associated with extreme sensitiveness on moving the head in any direction was added to her series of symptoms. The headache became severe, and on January 11 a somewhat doubtful choked disk made itself evident. This rapidly increased to a high degree of swelling, with rapid diminution of vision up to complete blindness. Paralysis of sensation and motion of the legs and sphincters remained complete. On January 13, a girl baby was born, low forceps alone being necessary after an absolutely painless labor. Convalescence from child-birth was normal and uneventful. Her mental confusion, however, increased; she made various complaints of pain in the back and unusual sensations in her arms. A careful objective examination was impossible on account of her disordered mind. Her interest in the baby was transient. She became incoherent, apprehensive at times, and toward the end of her life increasingly apathetic. A blood examination showed the following conditions. Hemoglobin, 80%; reds, 6,232,000; whites, 10,500. Stained specimen showed no achromia or other abnormality.

No blasts or plasmodia seen. Differential count of 500 whites showed: Polynuclear, 70.8%; lymphocytes, 26.6%; eosinophiles, 2.6%. Toward the very end of her life a slight paresis of the left facial nerve was observed, also slight disturbance in movements of the left eye. She became increasingly stuporous, with, however, evidence of pain from time to time in the back and head. She died March 25.

Autopsy. The autopsy showed a tumor of the spinal cord of a small round cell, sarcomatous type, originating in the cauda equina and sacral cord, destroying completely the lumbar cord and invading especially the dorsal aspect of the cord into the cervical region. The brain showed no other abnormality than an extreme hydrocephalus, evidently due to the blocking up of the subdural space of the cord by the tumor, thereby preventing the outflow of cerebrospinal fluid.

Diagnosis. A definite diagnosis was not made during life. A lumbar puncture would undoubtedly have given a dry tap and the study of possible cells found in the trochar might have determined the existence of a tumor. This examination should have been made. The relatively early destruction of the cord in the lumbar region led to the supposition of a transverse myelitis and confused somewhat the picture of Tumor. More stress should have been laid on the bilateral character of the pain, which is extremely characteristic of

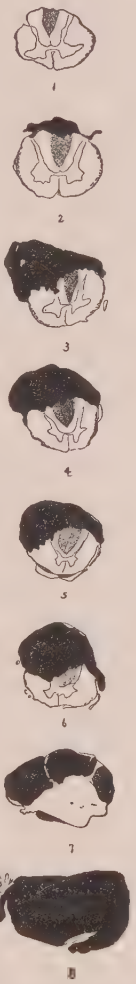


FIG. 25. CASE A.

Cross sections of cord from lumbar to upper cervical region, showing extent and position of tumor. 8, Lumbar region, practically complete destruction. In upper sections note dorsal sub-pial position of the growth. The secondary degenerations, mainly of the dorsal tracts, are explained by the partial destruction of the dorsal nerve roots, portions of the dorsal tracts, and to a much less degree of the dorsal gray leading to slight degeneration in Gower's and direct cerebellar tracts. (Accurate tracings, Edinger drawing apparatus.)

cord tumor. The further complication of definite cerebral symptoms of a mental sort together with manifest signs of intracranial pressure were not explained during life and again diverted attention from a lesion localized solely in the cord. In the light of the autopsy, much more stress should have been laid upon the pain, and particularly upon its bilateral character. The supposition should also have been entertained that a very probable cause of such a destructive lesion of the cord in a person of her age would be a rapidly growing tumor. The complication of pregnancy rendered the diagnosis still more difficult.

Prognosis. The disease was fatal in six months from the first symptoms.

Treatment. Had the diagnosis been early established with probable certainty, operative interference would have been justified. It is possible that an exposure of the cauda equina at a very early stage might have shown conditions which could have been relieved. This is, however, extremely doubtful in view of the extremely rapid growth of the tumor and of its manifestly malignant character. Without operation, palliative treatment was alone possible. Morphine should have been much more liberally used than it was to alleviate what must have been most excruciating pain owing to the invasion practically thoughout the cord of the dorsal nerve roots. Comparatively small relief was obtained from phenacetin and similar drugs of the coal-tar series.

Case 58. G., a boy of fourteen, had been well until he was eight years old. He then began to develop an unsteadiness of gait, insidious in onset, which was definitely established at ten. He had reached the high-school grade and had shown no mental deficiency. His mother had been married seventeen years and gave the following history of childbearing. The first pregnancy resulted in miscarriage at the second month; the second, a boy born at full term, was well; the third (the patient) was born eleven months after the preceding child; following his birth there were two or three miscarriages at about the second month. A boy was then born, later similarly affected as the patient (see later statement). Thereafter there were a number of miscarriages at about the second month. The mother and father had been well so far as known and no history of the affection from which the children suffered was obtained in other members of the family.

Examination of G. showed normal pupillary reactions with retained accommodation; no nystagmus; normal vision. The other cranial nerves showed no abnormality, either of motion or sensation. The boy was emaciated but without true muscular atrophy; sensation of the body and arms was unimpaired. There was, however, in spite of adequate strength in the hands, marked ataxia of both arms, equal on the two sides, with slight static ataxia also of the hands. The wrist and elbow jerks were absent on both sides. The abdominal and epigastric reflexes were more active on the right than on the left. The cremaster was equal on the two sides. There was no difficulty with the sphincters. The gross strength of the legs was excellent. The knee jerks were not obtained nor was there ankle clonus, Achilles, Babinski or normal plantar reflex. There was no deformity of the feet beyond slight hyperextension of the right great toe. An attempt to place the heel of one foot on the knee of the other side resulted in extreme ataxia, even with the eyes open, and was definitely increased with the eyes closed. In the attempt to rise from a lying to a sitting position, a general incoördination of movement was excited, including the head. There was marked unsteadiness on standing (Romberg); the gait on attempting to walk was exceedingly ataxic.

For some months his speech had been slow and hesitating. The heart area was normal; there were no murmurs; the liver and spleen were not enlarged; the abdomen was tympanitic but showed no definite abnormality.

G.'s brother W., eleven years old, had had pneumonia at two and had never been well since. He also was gradually growing worse with very similar symptoms to those of his older brother. He had slight nystagmus; marked ataxia of both upper extremities; absent reflexes in the arms; a systolic murmur at the heart apex. He was backward at school and had more or less incontinence, undoubtedly due to his defective mental development. His condition was in general similar to that of his brother, excepting that he was much more deficient mentally.

Fig. 26.

From a case of Friedreich's Ataxia, showing degeneration of the dorsal tracts, the lateral pyramidal tracts, the direct cerebellar tracts and Gower's (antero-lateral ascending) tracts.

Diagnosis. Ataxia developing in childhood, beginning in the legs and extending upward, later with disorders of speech and loss of deep reflexes, without anesthesia or sphincter trouble, constitute a group of symptoms which render the diagnosis of Friedreich's (hereditary) ataxia unmistakable.

Prognosis. The affection is very slowly progressive but death often results from intercurrent disease.

Treatment. Treatment is unavailing except to palliate the symptoms as they arise. The frequent club-foot deformities may be benefited surgically.

SECTION III.

BRAIN.

The possibility of accurate diagnosis of lesions of the brain depends upon a knowledge of the localization of its functions. The following diagram illustrates the cortical areas about which our knowledge is comparatively definite.

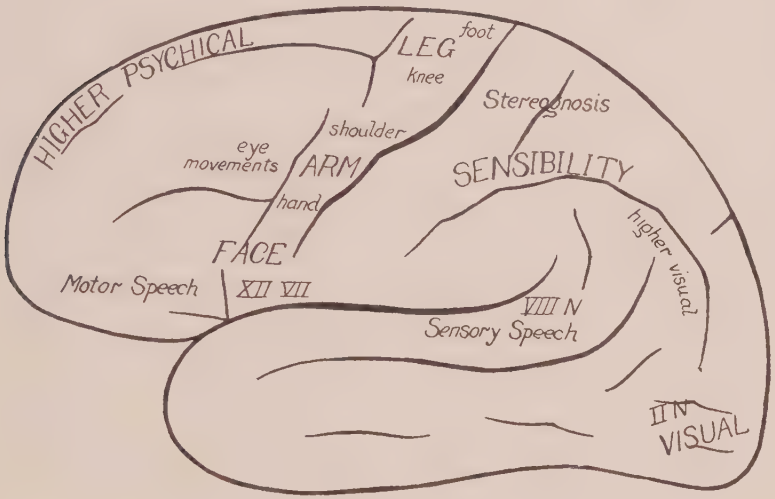


Fig. 27. Cortical Areas.

The internal capsule is constituted by projection fibers from the cortex, by sensory fibers from lower levels and by the fibers of the optic radiations. Their relation to each other and to the central ganglia bounding the capsule is shown in Fig. 28. Lesions in or about the capsule (see Cases 61–67) are likely to lead to the symptom of hemiplegia, because at this point the motor fibers to the face and extremities are concentrated in a small area. It is also apparent that sensory hemiplegia or hemianopsia may result from lesions of the dorsal portion of the dorsal limb of the capsule.

The twelve pairs of cranial nerves are distributed as follows: The first (olfactory) and second (optic) are outgrowths of the cerebral hemispheres; the third (oculomotor) and fourth (trochlear) arise from the quadrigeminal region; the fifth (trigeminal) from the upper part of the pons; the sixth (abducens), seventh (facial) and eighth (auditory) from the lower portion of the pons at its junction with the oblongata; the ninth (glossopharyngeal) and tenth (vagus) from the upper oblongata; the eleventh (spinal accessory) and the twelfth (hypoglossa) from the upper spinal cord and oblongata, respectively.

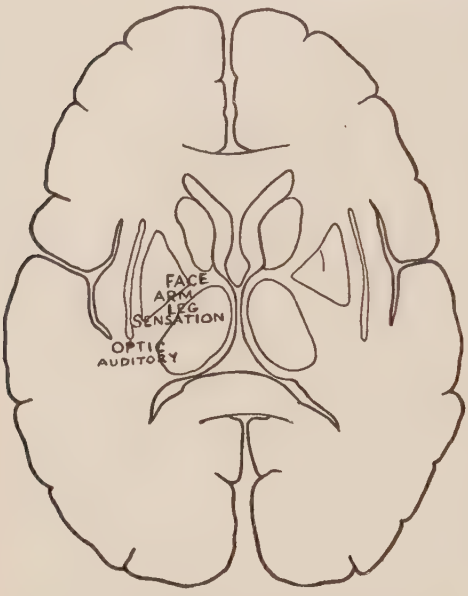


Fig. 28. Internal Capsule. Location of Tracts.

Their main functions are:

1. Olfactory — special nerve of smell.
2. Optic — special nerve of sight.
3. Oculomotor — intrinsic and extrinsic muscles of the eye, excepting the superior oblique and external rectus muscles.
4. Trochlear — superior oblique muscle.
5. Trigeminal — sensation to the face and motion to muscles of mastication.

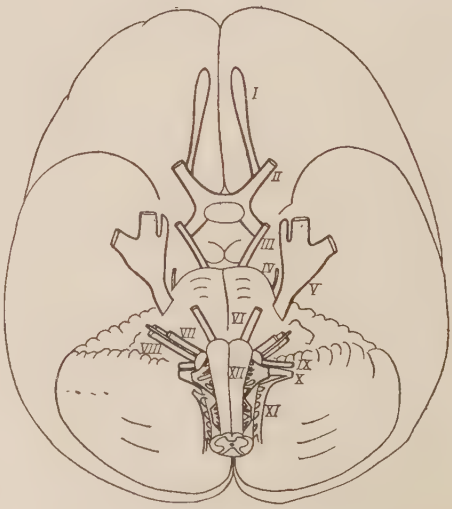


Fig. 29. Base of Brain. Cranial Nerves.

6. Abducens — external rectus muscle.
7. Facial — muscles of expression of the face.
8. Auditory — special nerve of hearing and equilibration.
9. Glossopharyngeal — taste, posterior portion of the tongue, fibers to pharynx.
10. Vagus — muscles of soft palate, pharynx and larynx, and sensory and motor fibers to viscera.
11. Spinal accessory — constitutes probably main portion of motor fibers to vagus; in its spinal portion supplies in part the trapezius and sternomastoid.
12. Hypoglossal — muscles of tongue.

Symptomatology. Brain disease manifests itself either by *general* symptoms or by *focal* symptoms, or by a combination of both. By *general* symptoms are understood those which indicate disorder of the brain, regardless of the location of the lesion, usually due to increased intracranial pressure. Of these, headache, nausea and vomiting, choked disk, and disorder of mental function are conspicuous. By *focal* symptoms are understood those which point, through disturbance of function, to definite, circumscribed areas of the brain or cord. Examples of such symptoms are, monoplegia of cortical origin, hemiplegia, hemianopsia, paralysis of individual nerves, aphasia, astereognosis.

Brain diseases are due to the same causes as are operative in other organs, the symptoms naturally suffering because of the peculiar and high degree of differentiation of cerebral function. Inflammation, vascular defects, faulty development, degenerations, traumatism and new growths are the common pathological processes, leading to symptoms or constituting diseases, as illustrated by the following cases.

Case 59. I., a man of thirty-five, had been successful in business, but for years had been regarded as eccentric. He had hoarded his money, had had a mania for keeping small coins, and in many other ways had demonstrated erratic behavior. He had been married for eight years and for five his wife had particularly noticed his peculiarities. For the previous three years he had grown much worse, became suspicious of his wife, and was extremely abusive in words but not in acts. He became doubtful of the trustworthiness

of banks, and had therefore formed a habit of keeping large amounts of money at home. For example, he had shown at one time to his friends $12,000 in $1,000 bank notes. For three years he had taken an excessive amount of alcohol, estimated at a quart of whiskey a day, and had done nothing in the way of work. Ten days before being examined he had had an epileptiform attack while in bed, from which a slight right paresis resulted, transient in character. He had become increasingly difficult to get on with and had become so threatening that his wife was afraid to remain in the house with him. Evidence of syphilis was not obtained.

Examination showed a stalwart man, evidently demented. His speech was very thick and extremely confused. It was entirely impossible for him to repeat a test sentence ("Third riding regiment of light artillery"). He declined to attempt to repeat the alphabet; he was doubtful about simple mathematical complications; he was unable to write his own name correctly; he said that February had 28 days in leap year and 30 at other times. He, however, knew the day of the week, the month and the year. The pupils were equal and responded normally to light. The knee jerks were normal, the heart negative; pulse, 116; blood pressure, 140. He had taken no alcohol for ten days. In general he had small mental grasp, as indicated in the foregoing history, but in the course of conversation showed no special grandiose ideas.

Diagnosis. The diagnosis of Dementia Paralytica was made in this case. It is evident, however, that the element of alcohol complicates the situation. In such cases it is important to determine, if possible, whether over-indulgence in alcohol is a cause or an effect of the mental state. In this instance, the evidence pointed to the fact that he had begun to deteriorate mentally before he had taken so excessively to drink. On the other hand, the symptoms were not incompatible with the maudlin state to which continuous over-indulgence in drink leads. In favor of alcohol as the etiological factor, is the fact that the pupils were normal and the knee jerks neither unduly exaggerated nor diminished. Over against this, and more weighty as evidence, must be placed the perfectly characteristic speech defect, the epileptiform seizure, followed

by temporary paresis of the right side and the persistent signs of dementia in spite of the fact that no alcohol had been taken for ten days. In such doubtful cases it is desirable to determine the presence or absence of syphilis by the Wassermann test, both in the blood and spinal fluid. The count of the cells in the spinal fluid is also of significance as a definite diagnostic criterion. Grandiose ideas are highly suggestive of dementia paralytica; their absence, however, should never preclude that diagnosis.

Prognosis. The outcome of dementia paralytica is invariably fatal. Under proper care at a hospital to which the patient was sent, life may be prolonged for several years. Remissions may occur but are not frequent.

Treatment. Careful nursing is essential. Antisyphilitic treatment in a well-developed case such as this accomplishes nothing.

NOTE. Eight months later, the patient was still at the hospital, gradually growing worse. Delusions of grandeur had become increasingly apparent and he was more excited. The hospital diagnosis was dementia paralytica.

Case 60. C., an unmarried man of thirty-five, had been at a hospital for the insane for a period of two years, ten years before being seen. The diagnosis of his condition at that time is not known. He had for some time suffered from a chronic intestinal catarrh and a certain amount of cystitis. He had in the past years fallen from a weight of 190 to 140. He had been constantly under the care of physicians and, in general, had improved. In April, 1900, he was found unconscious at his office with a slight cut over the left eye. He had a series of convulsions and was taken to a hospital, where the diagnosis of uremic poisoning was made. He entirely recovered from this condition and was apparently as before, excepting that he suffered considerable pain and for six months past had foolishly boasted of the amount of money he had made. Two days before being examined, he had been found in his room, swearing, garrulous and evidently mentally disordered. He failed to recognize people, and there was slight twitching of the face, which resulted in a definite convulsion limited to the right side, of slow onset and associated with complete loss of consciousness. The convulsive attack lasted about two hours, during which he passed urine involuntarily. In the afternoon of the same day, there was further twitching of the muscles of the face on the right, and also of the tongue. He apparently improved during the evening, but the next morning was unable to write, although he could copy. As time went on, he became clearer mentally, was able to understand better, but could not speak clearly. He was also unable to swallow properly.

When examined on August 26, the patient had a dull, stupid expression with a strong inclination to emotionalism. There was still a slight palsy of the hypoglossal nerve, and of the facial on the right side. The pupils were slightly unequal, irregular, the left larger than the right, with very poor light reaction and retained accommodation. There was no history of diplopia at any time and no headache. The hand grasp was about equal on the two sides and any previous paralysis of the leg had disappeared. The knee jerks were not obtainable. His speech was markedly defective, due apparently, in part, to his mental state and in part to the

remaining paresis of the twelfth and seventh nerves. He was able to name objects readily and to answer correctly a written question. He was also able to read, but mispronounced many words. When asked to write his name he succeeded in doing so somewhat imperfectly. When given a dictation he was confused and failed to accomplish what was asked. He wrote the alphabet laboriously and with the omission of several letters. He copied, however, easily and quickly. He was voluble in conversation and understandable when answering questions or saying very simple things. In describing his plans he was almost unintelligible and used many wholly meaningless words.

From this time he improved steadily in some respects. He had no further convulsive seizures, the facial paralysis practically recovered; the aphasic disturbance disappeared, but this was followed by a very characteristic and marked speech defect in which words were slurred and a general slovenliness of diction supervened. He talked extravagantly on many subjects, misspelled words of any length, was childish in manner and at times emotional. On one occasion, he wrote as follows: "Have passed a fine and good night; a fine day before me; read aloud; things going well; expect to get perfectly well; will live the best and most perfect I can after, and make all who know me happy." The knee jerks returned and were active, but no clonus developed. He became increasingly demented, gained somewhat in weight but developed no definite delusions. He had a marked sense of well-being and had many schemes for the future. He was committed to a hospital, grew rapidly worse with increasing speech defect and died some months later in a condition of deep dementia. The autopsy confirmed the diagnosis.

Diagnosis. This patient had Dementia Paralytica. In all cases of convulsive seizure or apoplectiform attack, particularly if associated with transient cerebral defects of the nature of aphasia or passing unilateral paralysis, the diagnosis of dementia paralytica should be seriously considered. In this instance, many months elapsed before this decision was reached, on account of the misinterpretation of the convulsive seizures. Had the whole situation been properly

considered by the physicians who saw him, particularly the condition of the pupils and the mental state, such an error could hardly have been made. The case, therefore, admirably illustrates the diagnostic value of seizures in dementia paralytica as well as the error to which these seizures may lead. The Argyll-Robertson pupil, with few exceptions, occurs only in this condition and in tabes. Its presence is, therefore, as in this case, of extreme diagnostic value and should always lead to a careful investigation of the mental state.

Prognosis. Dementia paralytica is a progressive and fatal disease, although the suggestion has recently been made that if treated in the very early stages it may be aborted or cured. The course of this case was somewhat rapid toward the end, but it is not to be questioned that the patient was suffering from the disease for a year or more before the diagnosis was definitely made. The usual term of life is from three to seven years.

Treatment. Beyond general hygiene and nursing, preferably at a hospital, treatment is unavailing.

Case 61. A., a man twenty-two years old, on the night of September 15, 1910, passed two men in a dark place, who were fighting with knives. One of the contestants ran, and the other pursuing him mistook A. for his victim and struck him a violent blow with his knife over the right temple slightly above and in front of the ear. The patient did not see the knife with which he was struck and was entirely unaware of the approaching attack until he found himself thrown to the ground. The knife was withdrawn and the patient was able to get to his house, which was in the immediate neighborhood. When he reached the house, he fell to the floor bleeding but still conscious. He was then taken to a hospital. At first, the blood spurted from the wound but stopped spontaneously before he was taken to the hospital. He lost consciousness for a period of about two days.

The immediate effect of the injury was a paralysis of the whole left side, with temporary numbness of the hand and arm. He had no speech defect, no pain, no headache and no vomiting. Except for the paralysis of the right side, he made a satisfactory recovery. Fragments of bone were removed at the hospital, but no detailed investigation of the brain was made. He has not been able to walk since the injury. Examination showed a depressed scar with loss of bone about one inch in length at the position stated above. The eye grounds were normal and the cranial nerves not involved, except possibly the facial muscles on the affected side, to a very slight degree. The left arm was practically helpless, contractured and with exceedingly active reflexes; wrist clonus was easily obtained. The leg was likewise useless and in a similar high degree of spastic contracture. The slightest irritation was sufficient to produce violent clonus. The Babinski reflex was present on the left, not on the right. There was no discoverable disorder of sensation. The patient later had several epileptiform attacks, which, however, were not localized. Beyond this fact, his condition remained essentially unchanged.

Diagnosis. In this case it seems evident that the knife thrust passed inward toward the posterior limb of the inter-

nal capsule on the right side, reaching to the immediate neighborhood of the motor fibers, but presumably not directly severing them, since the patient was able to walk a considerable distance to his house before falling, paralyzed. This paralysis was presumably due to an extension of Hemorrhage. It is probable that the knee of the capsule was not invaded, since the face was largely spared, nor was the posterior portion of the capsule involved, since sensation was unaffected. It is unlikely, from the character of the injury, the rapid onset of hemiplegic symptoms and from the unquestionable fact that the knife penetrated the substance of the brain, that the patient suffered a meningeal hemorrhage, which also, without operative interference, would almost inevitably have proved fatal. Such an injury to the capsule as this, with the resultant symptoms, not infrequently results from bullet wounds; but it is probably a unique history that such a clean-cut hemiplegia as developed in this case should be due to a stab wound.

Prognosis. The outlook for recovery of function of the affected side is extremely small.

Treatment. Operation was considered in this case, particularly after the development of epileptic seizures. Such a procedure, with exploration of the cortex immediately in the neighborhood of the wound, would have been justified; but, owing to a certain difference of opinion, was not attempted. A relief of the paralysis could certainly not have been secured by this means.

Case 62. L., a married man of fifty-eight, had worked hard and in recent years had had many anxieties because of business reverses, and the death of his wife and various relatives. About four months before being seen there was sudden slight loss of power of the right side; he dragged his foot somewhat in walking, but recovered in great measure and returned to active business life. About three months later he had an attack of disturbed breathing of the Cheyne-Stokes type, from which he completely recovered. Three days before being seen he suffered a paralysis of the right side, involving the face to some degree; when he recovered consciousness there was practically complete loss of speech, with marked Cheyne-Stokes respiration and general signs of distress. The urine for some time had had a slight trace of albumin, which was inconstant; repeated analyses were made.

On examination the pupils were equal in size, and reacted well to light; there was slight paresis of the lower branches of the facial nerve on the right side, with practically complete paralysis of the right arm and leg. The knee jerks were both present, and essentially alike; but there was a Babinski response on the right in contrast to a normal plantar reflex on the left. The heart apex was one inch outside the nipple line; the sounds were somewhat muffled; the second aortic was accentuated; there was no edema. The breathing was labored, and there was some mucus in the throat; he was, however, able to take food to a certain degree by the mouth. He smiled at times and appeared vaguely to recognize what was going on about him. His capacity to speak was, however, lost — aphasia of the so-called motor type. The pulse was 100, compressible but full; there was no palpable arterial sclerosis; the pressure was not taken. He had apparently improved slightly since the attack, but died four days after being seen, with a rising respiration and temperature, together with vomiting.

Diagnosis. Without a post-mortem examination, which was not obtained in this case, it is impossible to state with definiteness the nature of the pathological process causing the Apoplexy. In view of the renal complication, however,

with its accompanying vascular disturbances, it may be presumed that the paralysis was due to Hemorrhage in and about the internal capsule, rather than to softening of the cerebral substance, through thrombosis or embolism. The diagnosis of hemorrhage is also favored by the fact that the final attack was of sudden onset. The ultimate clinical signs are the same in either case; namely, a unilateral paralysis, usually associated with motor aphasia, if the lesion be on the left side of the brain, with partial sparing of the upper branch of the facial nerve, due, presumably, to its bilateral cerebral representation.

Prognosis. This case was hopeless from the outset. The brain disturbance of itself was no doubt extensive enough to lead to death, and this with an undoubted interstitial nephritis rendered the outcome doubly discouraging.

Treatment. The patient was made comfortable in the hope that nature might still be able to overcome the shock to which the brain was subjected. In general the treatment of cerebral apoplexy, in view of the fact that a positive determination between hemorrhage and softening is rarely possible, must be expectant. In cases of high arterial tension, blood letting is occasionally justified, together with sedatives, of which bromides may be taken as examples. An attempt to reduce the pressure by the nitrites is a questionable procedure in view of the fact that a diminution of general pressure may well tend to increase of the outflow of blood from the ruptured artery, presuming a hemorrhage to have occurred. It is probable that nature manages the situation wisely. If, on the other hand, there is strong evidence of weak heart action and a failing pulse, leading to the supposition that softening rather than hemorrhage has occurred in the brain, heart stimulation is justified by means of strychnia, caffeine or, under certain circumstances, digitalis, best given in the form of digipuratum.

Case 63. C., a woman of fifty-two and unmarried, had never regarded herself as well; she had suffered from what she called "fainting" when young, and palpitation of the heart; she had been careless about her diet, and had recently had an attack of "sore throat" which had resulted in peritonsillar abscess. On June 4, while at dinner, she noticed that her right hand began to feel numb; the sensation extended to her forearm; she was disturbed, and started to rise from the table, but sank back and rapidly became unconscious, with the development of a right-sided paralysis within the space of ten or fifteen minutes. At first she was able to speak, but not intelligibly; for half an hour she could be roused, but two hours after the onset she became absolutely unconscious and so remained, with slight intermissions, for a period of twelve hours. Thereafter there was some improvement.

When examined on June 11, one week after the onset, she was entirely conscious, but with very marked disturbance of speech, and slight difficulty in comprehension. The defect was chiefly, however, on the side of enunciation, associated with much paraphasia; she had difficulty in repeating and reading aloud, often misused words, and named objects very imperfectly; there had, however, been distinct improvement in this during the week of her illness. The pupils were small, with good light and accommodative reaction, and normal fields. The outlines of the optic disks were indistinct but there was no defined swelling. The right facial nerve showed slight weakness; other cranial nerves were free from disturbance; the right arm was completely paralyzed; the reflexes somewhat active, with unimpaired sensibility; the right abdominal reflex was lacking. There was also complete paralysis of the right leg, the right knee jerk was more pronounced than the left; ankle clonus was indicated and there was a Babinski response on the right, together with a more active Achilles than on the other side. The sensation of the right leg was delayed and blunted; the heart showed no lesion; the pulse was 84 and weak; the pressure, upwards of 170; the patient was rather pale in appearance, and of slender build.

Diagnosis. The presumable lesion in this case was Cerebral Softening in the usual distribution of the branches of the middle cerebral artery, rather than hemorrhage. As in Case 62, however, nothing dogmatic may be said on this point. Weight is simply lent to the assumption by the fact that there was a distinct prodromal period, characterized by sensations of numbness, and apprehension, followed by gradual loss of consciousness, which did not become complete for two hours. Such an onset suggests thrombus formation rather than hemorrhage. The rather weak heart action, as indicated by the pulse, is further evidence in favor of softening. The lesion involved the left internal capsule at, or about, the region of the knee, since sensation was largely though not entirely spared. The absence of the abdominal reflex on the side of the paralysis is a valuable diagnostic sign.

Prognosis. The patient continued to improve. With care there is no reason why she should not recover a high degree of usefulness, although the spastic weakness of the right side will not entirely disappear, and the speech is likely to remain faulty.

Treatment. Rest in bed, care of the bowels, a nutritious, simple diet, and general heart stimulation were prescribed in this case.

Case 64. A., a man of sixty-eight, married, without occupation for several years, had considered himself well up to July, 1906. At that time he was obliged to be in the hot sun for several days, following which he woke one morning with a feeling of numbness in two of the fingers of the left hand, which gradually extended to the arm. (See Case 63.) At the end of two or three days he lost all strength in that arm; the leg was not then affected. He had massage during the summer and improved very considerably. On March 31 of the following year, he had a second attack, affecting the left side, arm and leg. From this he again improved. Two months later he had a third attack, and since then up to the time when he was seen in July, 1907, he had had a number of slight seizures associated with convulsive movements. He felt weaker after each of these attacks, and suffered from "jerking" of the arm and leg, which exhausted him greatly. His appetite, however, had remained good, and his sleep was satisfactory. His chief annoyance at this period were frequent slight convulsive attacks involving the arm and leg.

Examination showed the right pupil to be slightly smaller than the left, with adequate light response and defective accommodation, as often seen in persons of his age. The tongue was protruded to the left; the sensation of the face was normal; paralysis of the face was not noticeable; the speech was slightly disturbed, somewhat thick and lisping, but he never lost the capacity to speak.

The heart impulse could not be felt through the chest wall; the sounds were faint, with probable slight accentuation of the second aortic. The pulse was 84, regular, compressible and without sign of definite radial sclerosis. The left arm was weak in all of its movements, and there was considerable edema of the left hand; sensation both of arm and leg was normal. All the arm reflexes on the left were increased; the abdominal reflex on that side was lost. The left leg showed very slight weakness, with a slight increase of the knee jerk and without Babinski; there was no edema, and the patient made no special complaint of the leg, except that he had an extremely slight limp. He had taken alcohol in some form for years, but never in great amount.

This patient was seen again six months later; during the intervening period there had been a distinct increase of the left-sided weakness. The face was still unaffected; the left arm was extremely weak, slight movements in the fingers only being possible; the arm reflexes were increased; sensation was still normal; the pulse rate was 76, slightly irregular; the heart sounds fairly clear, without murmurs, and without definite accentuation of the second aortic. The left leg could be moved in some degree; the knee jerk was active; the Babinski response definite; Achilles active; clonus indicated. The right leg was normal. It was of interest that an attempt to close the fingers of the affected hand induced flexion movements of the toes of the same side ("*Mitbewegung*").

Examination of the urine showed a normal amount in the twenty-four hours, specific gravity 1,015, acid, no sugar, no albumin.

Diagnosis. The interest of this case centers in the fact of its gradual onset, ultimately resulting in a high degree of paralysis of the left arm and leg, with almost complete sparing of the face. This type of Apoplexy is not unusual, and is doubtless to be attributed to a cerebral vascular disorder dependent upon imperfect circulation, presumably due directly to gradual occlusion of vessels supplying the capsule and its neighborhood.

Prognosis. In cases of this type of gradual onset, associated with preliminary signs of irritation, spasm and the like, followed by weakness and ultimately paralysis, the outlook is always grave. In a period of about a year and a half this patient underwent these various stages, beginning with an apparently trifling numbness of one hand, and ending with an essentially complete paralysis of arm and leg.

Treatment. In spite of heart stimulation and general hygiene, the process could not be checked.

Case 65. S., a married woman of thirty-one, three years before had had a stillborn child; she had, however, been well up to the birth of a second child two weeks ago. The labor was long and arduous; instruments were, however, not required, and her illness had been in no way unusual until the day before being seen. It was then noticed that she was moaning in her sleep, and when spoken to she continually said, "I can't help it." There was some contortion of the face, but no general convulsion; later she was able to nurse her baby; the following day she was apathetic and disinclined to speak; she appeared to be drowsy, and yawned continually; the tendency, however, was toward improvement.

Examination showed the pupils to be slightly unequal, dilated, the right larger then the left, with retained reaction to light and distance; there was a very slight facial asymmetry, the right side being affected. This, however, was not noticeable on voluntary movement, such, for example, as showing the teeth; there was no other cranial nerve involvement. The right arm was moved less well than the left; but weak movements were still possible. The arm reflexes were the same on the two sides; no abdominal reflex was obtained on either side; the right leg was decidedly weaker than the left, corresponding to the condition of the arm. The knee jerks were present, slight on both sides, and apparently equal. There was no ankle clonus, and no Achilles response; there was, however, a definite Babinski reaction on the right, with a marked normal plantar on the left; the sensibility of the face, arm and leg was unimpaired. The heart sounds were normal; the second aortic sound was not exaggerated, and there was no apparent radial sclerosis. The pulse was 100, and regular in time. Speech was markedly affected; simple commands were in general understood; but a request, for example, to put out her tongue resulted merely in opening the mouth. She had an extremely small vocabulary and presented a typical picture of so-called motor aphasia.

Diagnosis. Owing, no doubt, to the vascular strain incurred during pregnancy and childbirth a cerebral vessel in the neighborhood of the left internal capsule involving the lenticular zone and presumably Broca's convolution (third

left frontal) was ruptured, leading to a right Hemiplegia of moderate degree. The importance of the Babinski sign is well demonstrated by this case.

Prognosis. Improvement will occur without complete restoration of the function of the affected side.

Treatment. The treatment is essentially to give natural processes the best opportunity possible; to this end nursing of the baby should be stopped; rest, both physical and mental, required, and such drugs given as the condition of the circulation demands, as described in previous cases.

Case 66. E., a child of ten, had not been well since her fourteenth month. She was a second child; the birth was easy, and for the first year of her life she had been well; when about fourteen months old, after a violent attack of coughing, following measles and bronchitis, she had had a severe convulsive attack, with subsequent left hemiplegia. Two days later the convulsions recurred with increasing violence and lasted for a period of hours. From that time on the patient had recurring attacks of conjugate eye deviation toward the right, accompanied by attacks resembling *petit mal.* The original hemiplegia improved to a certain degree. For several years the convulsive seizures were infrequent; but later, and up to the time of examination, the attacks had increased in frequency and had assumed a distinct epileptiform character. The child did not talk until three, and at school had remained one year behind.

Examination showed normal pupils. There was a definite left hemiplegia, sparing the face, accompanied by a strong tendency to athetoid movements of the hand. She limped somewhat. Mentally she was clear, so far as could be determined by a somewhat superficial examination.

Under a moderate treatment with the bromides, the attacks for which she chiefly sought advice were distinctly modified. She seldom fell, but continued to have seizures of *petit mal.* She later became irritable and somewhat debilitated; her subsequent history is not known.

Diagnosis. This case is to be regarded as one of Infantile Hemiplegia associated with Epilepsy. It is probable that after violent coughing, following a double infection, a cortical vascular disturbance was induced, sufficient in degree to injure the motor cortex. The amount of injury must have been considerable, inasmuch as a hemiplegia resulted, as well as convulsions of violent character, which later developed into typical epileptic attacks. It is altogether probable in such cases that the cause of the epilepsy is mechanical, inasmuch as it is often associated with a manifestly destructive lesion, causing unilateral paralysis. It should be remembered that hemiplegia in young children is due, in the great proportion of cases, to cortical lesions rather than to those in and

about the capsule. The association between early convulsive seizures and later epilepsy is illustrated by this case.

Prognosis. Improvement under treatment occurred, and should continue. The child, however, will no doubt remain slightly handicapped, both physically and mentally.

Treatment. Sodium bromide was given in doses of from 10 to 30 grains daily; the diet was regulated, particularly with reference to the use of meat. Under these conditions the child improved, but the attacks were not completely controlled, although diminished in frequency.

Case 67. H., a woman of forty-five, unmarried, had suffered since the age of seventeen with joint pain and swelling of the feet, undoubtedly rheumatic in character; she had at various periods had attacks of vertigo, heart palpitation, dyspnea and, on exertion, orthopnea. Her heart area was enlarged, and she had long had a presystolic cardiac thrill and souffle. She had continually been in hospitals on account of her heart condition. On September 5, 1895, she had been feeling poorly, had a slight fever, and took to her bed on account of general weakness. The day following, while sitting in a chair, she suddenly experienced a feeling of numbness and pain in both legs; she was temporarily unable to walk, but rapidly improved after a few days. On October 1, while at breakfast, she suddenly fell back unconscious; her face was flushed, but her breathing was not stertorous. There was immediate paralysis of the right side, including the face; she partially recovered consciousness in a few hours, but suffered from hiccough and inability to swallow for a period of two days. There was retention of urine for three days, followed by incontinence. She was also markedly aphasic; but in general there was gradual improvement in the following six weeks. She had some pulmonary edema which caused discomfort while lying down. On December 18, she suffered an acute collapse; the skin was cold; pulse, 180, of poor quality, and the expression anxious. There was, thereafter, a gradual development of blue blotches on various parts of the body, varying in size from minute points to areas as large as a fingernail. This was particularly marked on the legs and the lower abdomen up to one inch above the umbilicus. At this level there was a definite line marking the upper limit of lividity. This condition also improved, except over the left leg below the knee, where the cyanosis distinctly increased.

On physical examination at this time speech was impossible and she had some difficulty in expressing herself by sounds. Her understanding was also not perfectly clear, as shown by the fact that she could not comply with a simple request, such as to show her tongue. The pupils reacted slightly; the pulse was irregular, the radial artery not noticeably rigid; the lungs were normal; the heart gave a presystolic thrill

at the apex; the second pulmonic sound was increased, and there was slight enlargement to the right; the spleen and liver were normal. The left leg below the knee and extending halfway up the thigh was cold; the foot and leg nearly up to the knee were discolored to a high degree; no pulse was felt in the femoral artery; there was no knee jerk on the left side; the leg behind the knee was tender on pressure. The right leg was completely paralyzed, with very active knee jerk and slight ankle clonus; the pulse could be felt both in the femoral and popliteal arteries; the right arm was also paralyzed, with contractures at the elbow, wrist and fingers. The state of the patient was such that a sensory examination could not be made. The blood showed 4,868,000 red cells and 11,000 white, with hemoglobin 73%. The urine gave a trace of albumin; specific gravity 1,018; no sugar; abundant hyaline and fine granular casts; a few renal cells; epithelial cells, leucocytes and triple phosphates.

She grew worse, and died January 16.

The **autopsy** showed the following conditions: Chronic mitral endocarditis, with stenosis; slight aortic insufficiency; dilatation of the left auricle, with a thrombus in the appendage; embolism of the middle cerebral artery with softening; embolic infarction of the spleen and kidneys; embolism and thrombosis of the iliac arteries; dry gangrene of the left leg below the knee.

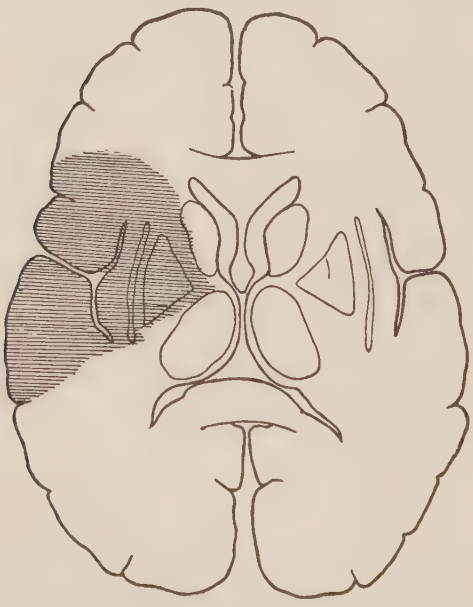


FIG. 30. CASE 67.
Shaded area shows approximate extent of softening.

Diagnosis. This case offers a peculiarly clear picture of definite clinical significance; of Embolism consequent upon a damaged heart. The patient had rheu-

matism in her early years followed by various heart symptoms, which did not reach the point of danger until about her fortieth year; she then had a series of disturbances undoubtedly due to embolism arising from the damaged heart valves, with accompanying thrombosis. She finally suffered a definite apoplexy with paralysis of the right side, and aphasia, of extremely sudden onset, due to embolism of the left middle cerebral artery. This was followed by the detachment of another and no doubt larger embolus, which was temporarily stopped at the bifurcation of the aorta into the iliac arteries, as shown by the bilateral cyanosis of the legs reaching to about the level of the umbilicus. Later, it was evident that this embolus was dislodged and passed into the artery of the left leg, ultimately leading to gangrene through cutting off the blood supply, whereas the right leg recovered its normal color. Death no doubt ultimately resulted from still another embolism. The diagnosis in this case, therefore, readily made during life, was endocarditis, embolism and thrombosis, with left-sided cerebral softening. These suppositions the autopsy verified.

Prognosis. A large part of this patient's life was spent in hospitals, often as a helper. It was doubtless due to strict care and close medical supervision that she so long escaped the fate which finally overtook her. The outcome of such cases naturally depends upon the possibility of avoiding the detachment of emboli. No doubt a guarded life conduces to this end; the situation, however, under the best possible conditions, never ceases to be threatening.

Treatment. The only available treatment is prophylaxis. In this case the heart compensation had not failed, and no warning was given of the possible detachment of emboli. When the apoplexy finally supervened, little could be done beyond relieving the superficial symptoms as they arose. The general condition of the patient did not justify amputation of the gangrenous foot.

Case 68. I., a man of seventy-five, for some years past had been gradually losing his mental grasp in the way of showing lack of initiative, doubts and difficulty in keeping his mind fixed on any special object, although formerly a person of great resources. Examination showed no objective physical defect beyond a high blood pressure, tortuous radial arteries and slightly disturbed general nutrition. He was, however, quite able to care for himself, to go about at first alone and later with an attendant, and in the earlier stages to take a certain interest in reading and similar diversions. He was tormented continually by doubt as to any given course of action and spent much of his time in weighing the advantages of various plans for his own betterment. During the period he was under observation, he traveled considerably, always with scepticism as to its advisability, and became, as time went on, increasingly unhappy and fearful for his mental equilibrium. At times, he had temporary periods of confusion in which he would for a short period be irresponsible and do various unusual things quite out of accord with his custom. He also had periods when speech was difficult and his words were confused. This, however, never amounted to a true aphasia. No paralysis developed and his appetite and bodily functions remained essentially normal up to the time of his final acute illness. General mental and physical failure were, however, apparent to those about him. The urine at no time showed any significant abnormality. A sample examination follows: Twenty-four hour amount, 46 ounces; clear, acid, specific gravity 1,013, slightest possible trace of albumin, no sugar, no diacetic acid, no acetone, very slight sediment, consisting of a rare squamous and small round cell with no pus or blood; one coarse granular cast was found in two slides after long search.

One morning the patient suddenly became confused while at the breakfast table. He was at once unable to walk, though not definitely paralyzed. Speech was difficult and he showed much restlessness, attempting to get up continually from a couch where he was lying. An examination showed the pupils to be equal, with a definite but slight light reaction; there was no facial paralysis. The pulse was 80, the blood pressure

245 or more. The heart sounds were somewhat obscure and a definite accentuation of the second aortic sound could not be determined. The arm reflexes were extremely active, but there was no paralysis. The knee jerks were also very active, as was the Achilles reflex. There was, however, no Babinski or clonus. He was restless and confused. In the afternoon of the same day the pressure still remained high, and a slight left paresis had begun. The reflexes as before were very active on both sides, but no abdominal reflex could be obtained on either side. Speech was very much disturbed and practically unintelligible, and his mind was evidently confused. He grew gradually worse with a steady fall of blood pressure, rising respiration and pulse and a constant temperature of about 101°. The reflex condition remained the same. There was no definite paralysis at any time and the face was apparently entirely spared. Under these conditions he died, five days after the onset of the last serious attack.

Autopsy. The post-mortem examination showed the body organs, including the heart, in a remarkably normal condition for a man of his age, seventy-nine years. The kidneys, for example, showed no definite degeneration, a matter of interest in connection with the terminal high blood pressure. The brain, on the contrary, had suffered greatly from arteriosclerotic changes. The circle of Willis was highly degenerated and the cortex showed some, though not definite, signs of atrophy. A small hemorrhage about one centimeter in diameter was found in the pons, presumably the cause of the final attack. No other pathological lesion than that of arteriosclerosis was revealed to account for the condition observed during the later years of life.

Diagnosis. Such a case may properly be classified as Arteriosclerosis. The autopsy justified the opinion entertained during life that there was no marked physical defect in the central nervous system or elsewhere except that incident upon old age with its accompanying or causative arterial degenerations.

Prognosis and Treatment. Life may be prolonged for long periods under conditions of extreme arteriosclerosis by

scrupulous care as to diet, exercise and occupation. Meat should be curtailed and the dietary made both simple and nutritious; particular care should be taken of the bowel function, for the regulation of which no drug is so useful as cascara sagrada, either in the form of the fluid extract or tablets of the extract. Phosphate of soda, a teaspoonful, best given in hot water before breakfast, was found useful in this case. More important than the drug treatment is the general physical care, and perhaps even more important than that, certainly for the happiness of the patient, is a tactful manner of preparing the troubled mind for its inevitable disabilities.

Case 69. S., a man approximately seventy-two years old, was seen November 30, 1906. The patient for the most part had led a sedentary life, and for some years past had shown the inroads of time by a general failing in strength. Physically he was handicapped by a marked curvature of the spine, rigidity of the spinal column and of the bordering muscles. He had presumably had two slight hemiplegic attacks in preceding years, one on each side, from which he had in general recovered.

Physical examination showed a high degree of radial sclerosis with somewhat weak heart sounds. The knee jerks were active, but there was no Babinski phenomenon and no evidence whatever justifying the supposition of a systemic degeneration of the pyramidal tracts. Although in general he presented many indications of advancing years, these were wholly out of proportion to the extraordinary disturbance of gait from which he suffered and which had virtually made him a prisoner in his house. There was no paralysis of the legs, and in general the muscular strength was sufficiently good. In spite of this fact there had been increasing difficulty in locomotion, characterized by extreme difficulty in starting, a tendency to shorten the steps more and more as progress was made, and the incapacity to make a movement forward of more than a few inches. The patient was obliged often to stop, after going a few yards, tired with the amount of muscular effort which he had been called upon to make.

The gait might be properly enough described as " stammering or stuttering." After once getting started, particularly if helped by a little moral suasion, he was able to walk reasonably well for a short space, with steps of considerable length, until the movement was checked through sudden fatigue, or more probably through lack of confidence in his capacity to proceed.

Diagnosis. In the absence of adequate organic cause on the part of the nervous system, this patient may properly be said to be suffering from a condition of Senile Trepidant Abasia (Charcot).

Prognosis. In view of the age of the patient, the condition of the blood vessels, and the difficulty of overcoming more or

less fixed tendencies in the later period of life, the prognosis, so far as recovery of normal locomotion is concerned, is not good. Improvement may take place, but complete recovery does not.

Treatment and Remarks. This patient improved and was able to walk decidedly better under instruction, accompanied by a considerable degree of firmness and reassurance as to his capacity in that direction. This type of disturbance certainly demands, by way of explanation, something more than a physical cause for its existence, since examination of such patients shows no sufficient physical incapacity to account for the gait. There is no paralysis; movements in other positions may be made with comparative ease and freedom; the individual muscular movements of walking may likewise be accomplished without difficulty, but the entire act of taking steps voluntarily results in the stammering tendency to which allusion has been made. Explanation, encouragement and instruction, on the other hand, quickly produce results, and it is not difficult to induce such patients to walk with comparative ease through the use of such simple means. It is, therefore, apparent that we have in this disturbance to deal with a mental defect, presumably dependent upon the senile changes of cerebral vessels, which have, however, not led to sufficient injury to produce marked degeneration of the motor tracts. At this time, when the general subject of arteriosclerosis is demanding much attention, it is worth while to call attention to this trepidant abasia of the aged as illustrative, not only of the infirmities which the vascular lesions themselves produce, but also as demonstrating the probable secondary effects upon the mind, which in turn lead to a lack of confidence, finally resulting in a practical incapacity for voluntary walking movements. The interest of these cases, therefore, lies not so much in the gait disturbance itself as in the curious chain of events which finally brings it to pass. Much may, no doubt, be done in the way of treatment by perseverance, both on the part of patient and physician, in retraining the motor functions through an appeal to the will.

Case 70. T., a man of forty-five, about August 1, 1910, had an attack the exact character of which cannot be determined. It is supposed, however, that it was of gradual onset with temporary paresis of the right hand and leg, associated with some disturbance of vision in the right eye and a very marked difficulty in speech. The first thing he himself noticed was that he was unable to deliver a message. A month later he had what was supposed to be an epileptic attack. Since then he had had three or four similar seizures, in one of which he was seen while sitting in his chair to have convulsive movements of the hands and arms, with distortion of the face, associated with apparent unconsciousness and mucous discharge from the mouth.

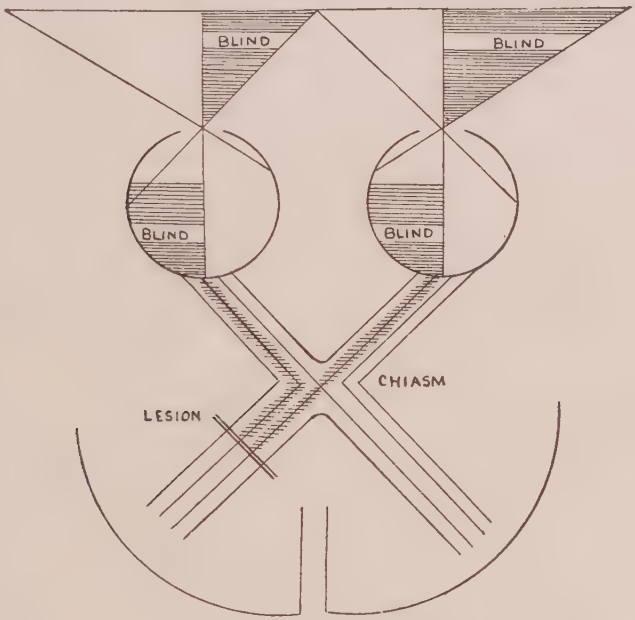


FIG. 31. CASE 70. Hemianopsia.

When examined, on November 25, there was a scarcely noticeable weakness of the right foot and right hand and an almost complete loss of the power of speech. His vocabulary at that time consisted of hardly more than the words "yes" and "no." The knee jerks were active; the pupils reacted to light and on accommodation, the right being slightly smaller

than the left. The heart was regular in action, slightly enlarged, with a definite musical systolic murmur at the apex. The urine was high colored, specific gravity 1,015, no sugar, a large trace of albumin, with sediment consisting of occasional small round cells and leucocytes, together with some squamous and epithelial cells. There were numerous hyaline and granular casts, but no blood or fat. He improved somewhat and enlarged his vocabulary to a slight but not useful degree. He was finally admitted to a hospital for chronic disease, March 8, 1911, where the following supplementary examination was made: Pupils equal; good reaction to light and on accommodation, with normal ocular movements. Vision restricted to the left half of the field (hemianopsia), tongue protruded in the median line, clean and moist; teeth in fair condition, throat negative, chest symmetrical and without disease of the lungs. The heart apex was in the fifth space, somewhat enlarged toward the left; the sounds were clear, the first accentuated and accompanied by a questionable thrill. With the second sound at the apex was heard from time to time a squeak, transmitted downward and into the axilla. The aortic second sound was not greater than the pulmonic second. The abdomen showed no abnormality. The legs were normal; the original slight paresis had disappeared. The urine also showed no further abnormality than a high specific gravity with an alkaline reaction.

A more detailed examination of the aphasia revealed the following conditions as examined March 31, 1911. The tongue was tremulous but freely movable; there was no paralysis of the facial muscles nor was the larynx affected. Right hemianopsia was easily demonstrated. Spontaneous speech was not possible. He was unable to repeat, "This is the Long Island Hospital," or "This is a pleasant day." He named objects with the following results: Pencil — Eskimos; watch — correct; chain — correct; knife — unable to answer, but when the word was mentioned he agreed at once; note book — doesn't know; keys — correct; one-cent piece — copper; five-cent piece — unable to answer; twenty-five cent piece — unable to answer. He was unable to copy and apparently did not clearly understand what he was asked

to do. When asked to write, declined on the ground that he could not see (hemianopsia); asked how old he was, could not answer. His comprehension was very defective. When asked to touch his nose with his forefinger, he failed entirely to understand. When asked to put out his tongue, opened his mouth instead, and thrust out his tongue when told to close his right eye. He was unable to touch his right ear at command; when asked to pick up variously shaped pieces of paper he mistook a small piece for a long piece several times, but some of the commands involving thought he carried out correctly, which showed considerable improvement.

Diagnosis. The lesion in this case is vascular in character, possibly embolic in view of the definite heart lesion. The middle cerebral artery is undoubtedly the seat of the difficulty, the lesion invading to a very slight degree the internal capsule and extending more posteriorly into the zone of sensory speech, interrupting also the optic fibers as shown by the presence of hemianopsia. The aphasia is of a mixed type, since he not only understands very imperfectly but is also unable to enunciate words, in striking contrast to the condition described in Case 71. The element of paraphasia is, however, lacking in this case. In spite of the marked motor defect, it seems probable that Broca's convolution (third left frontal) is not invaded by the pathological process, and that the lesion lies rather in the lenticular zone and posterior to that region. The association of a marked sensory defect with hemianopsia bears out this supposition.

Prognosis. The patient has steadily improved since the original attack. The renal disturbance was apparently transient, as shown by the later urinary examination, and the epileptiform attacks have not recurred. The aphasia has improved somewhat, but he is not likely to regain anything approaching perfect speech.

Treatment. Attention should be given to the heart, which is, as yet, well compensated; the urine should be examined from time to time and the diet regulated in view of possible kidney complications. The aphasia might be improved somewhat through training, but further spontaneous improvement will be increasingly slow.

Case 71. O., a widow of sixty-four, during a period of two and a half years had had several attacks of apparent acute indigestion characterized by sudden vomiting, with a slight rise in temperature. These attacks lasted about one week and were thought to be traceable to overwork or indiscretion in diet. She recovered completely from each of them. For six months preceding the time when she was examined she had been increasingly irritable and at times was unable to say what she wished to. She was also unable to play cards as well as formerly. One week before being seen, while in a condition of apparently good health, she had an attack such as those described above, associated with headache and a marked difficulty in understanding what was said to her. The fundus was said to be normal. A consultant, who saw her at this time, found her thoracic and abdominal organs normal and diagnosticated a brain tumor.

Examination. The first impression of this patient was that she was mentally disordered and in a highly excited state, associated with much confusion. On investigation, however, it was forthwith apparent that this seeming mental disturbance was due solely to a marked speech defect from which she was suffering. She continually used meaningless words, which to her mind apparently conveyed a definite idea. She also confused her words in constructing sentences. She was, however, extremely voluble and had not the slightest difficulty in enunciating or finding a word, although it was often an incorrect one, to convey the meaning she desired. She refused to name objects held before her and said she couldn't. It was also doubtful whether she understood the use of objects (apraxia). The misuse of words was striking; for example, her physician had recently shaved his moustache. Regarding this, she said, " You have sawed off your face." Again, speaking of her eye, she said, " I have done a lot of work with that dog." Spontaneous writing was imperfectly possible; she was unable to copy. The alphabet was written as follows: a b s d f e ft get hav i ju K l m n o op, etc. Given a dictation, " This is a pleasant day," wrote, " This is a dleasant." Examination of the visual fields showed a left hemianopsia. This patient greatly improved later, recovered

practically normal speech and became essentially as well as before the attack.

Diagnosis. It is altogether probable that the condition described above was due to a disturbance in the circulation of the left middle cerebral artery, supplying the region of the island of Reil and presumably the upper temporal convolution. The Aphasia resulting fromt his lesion was of the sensory type, characterized by an incapacity to understand, associated with paraphasia well exemplified in this case, together with the subsidiary defects of writing and copying. The fact that she had no difficulty whatever in finding words, incorrect as they usually were, and spoken without the slightest hesitation, indicates that the more anterior portion of the zone of language was not affected. The existence of hemianopsia goes to show that the lesion extended posteriorly to a point in the region of the angular gyrus with an interruption of the fibers of the optic radiation of the left side.

Prognosis. As stated in the history, the patient recovered almost completely from this attack. Others are likely to follow, probably proving more serious.

Treatment. The treatment was symptomatic. In such cases, if the heart action is weak and there is evidence of thrombus formation in the cerebral vessels, it is desirable to use stimulants, of which strychnia is, perhaps, the best. A condition such as that described in this case is more likely to result from this cause than from hemorrhage.

Case 72. R., a man of thirty-five, otherwise well, and active in his professional work, had for some years had a more or less acutely suppurating middle ear on the left side. This had occasioned him no great inconvenience until finally he had had considerable pain in the mastoid region and came to Boston to consult an aurist. After examination it was considered probable that the mastoid cells were involved in the suppurative process and that an operation for its relief was demanded. This operation was done under great difficulties owing to the fact that the anesthetic was very badly taken; the patient was stout and the mastoid portion of the bone was extremely small. Nothing definite was found as a result of this operation. The patient, who had previously shown some signs of cerebral disturbance, did not improve. He had a slight continued temperature, and a very definite speech defect gradually developed. In other respects, he was not at that time seriously ill. He was able to be about, dressed, and took a considerable degree of interest in the progress of his condition.

Examination showed that he had no hemianopsia. His understanding of commands was imperfect, he misused words, wrote with many mistakes and made himself understood with the very greatest difficulty. When shown objects and asked to name them he rarely did so correctly. A list follows: Ring — " ring." Pen — " wentum nebo "; when asked what one does with it, said, " You write with it." Fan — " book of ridal surgents. It's ridal surgents. I mean by that a book which has its name on surgery. Fan stands for fan. Is that a fan? Probably yes." Handkerchief — " shauma — lamp, looks a good deal like a lantern." Necktie — " I call that a regular iron wing." Keys — " trees, but I don't know which ones." Flies — " birds." Automobile, when seen in a picture — " epileptic something." Spontaneous speech: " Now, why is it that a fellow can say, well, now suppose, like a cane fellow, why is it he says too much, too little, why is it such fellow is revaiste, why is it that I have to look around at this and that and that sort of business, I don't believe it can be fixed right away." He was entirely unable to read; he used words of slightly the same sound

but wholly unmeaning. Some words were pronounced, but evidently he did not understand what he read. He spelled with great difficulty. When a question was written, he understood it. When asked to copy, he did not clearly realize what was meant. When asked to write "This is a very warm day," began "Dear sir, please send me a sider." When asked to state how he felt, wrote, "I don't feel, I feel very ———." These difficulties increased so that his speech became practically unintelligible. Vertigo developed and his general condition grew decidedly worse. Operation was unwisely deferred, largely because it was felt after the previous experience that he could not survive the necessary exploration. After reaching a somewhat alarming condition, suddenly one night there was a gush of pus from the left ear with an immediate improvement in all symptoms and a complete restoration of speech. The following day the patient wrote an absolutely perfect statement in a clear, bold hand with no mistakes either in spelling, punctuation or phraseology. He spoke equally well. The ear continued to discharge a greenish pus for a week or ten days and then spontaneously ceased. The patient to all appearances was entirely well. He spent a comfortable and enjoyable summer but was admitted to a hospital in the fall with similar symptoms to those already described. Operation undertaken at that time resulted in death on the table. The exposure of the left temporal lobe revealed a large abscess cavity filled with pus, which the later autopsy showed had disintegrated a considerable part of the temporal lobe.

Diagnosis. Cerebral Abscess was probable as soon as symptoms on the part of the brain manifested themselves. It was rendered almost certain by the development of an Aphasia of the sensory type. The discharge of pus from the ear absolutely established the diagnosis. The aphasia was characterized, as indicated in the history, by faulty understanding (word deafness), incapacity to express himself on account of the misuse of words, with retained capacity to speak. The lesion causing this disturbance lay in the temporal lobe and did not invade the lenticular zone, although, undoubtedly, certain of the conduction fibers from the tem-

poral lobe were destroyed. The lesion did not reach the optic fibers, as shown by the absence of hemianopsia.

Prognosis. Untreated cerebral abscess is finally fatal in the great majority of cases. It is, however, possible that such lesions may occasionally remain latent for long periods with ultimate obliteration of the cavity.

Treatment. The treatment of cerebral abscess is surgical. It was, as the event proved, a false hope to suppose that a spontaneous evacuation of pus through the ear would result in cure. A slow refilling of the cavity led directly to the final fatal outcome. There was no reinfection, but the bacteria (B. pyocyaneus) were sufficiently active to lead to a reformation of pus.

Case 73. I., a man of thirty-three, was seen October 22, 1906. He was unmarried and an engineer by occupation. Seven weeks before, he had had an acute suppuration of the right ear, preceded by pain. No operation or interference was attempted at a hospital to which he went for treatment. He was thereafter able to do some work, but with diminished capacity. For the preceding four weeks, however, he had remained at home with varying feelings of discomfort, chiefly of pain, which was practically constant on the right side of the head, radiating through the eye of that side and through the vertex and occiput. For three days he had been decidedly worse; his appetite failed; he was dull mentally and took to his bed. Vertigo supervened and he failed to recognize a close relative. His mind, in general, was wandering and uncertain, showing considerable confusion.

Examination showed the following conditions: The patient lay with his eyes closed, extremely apathetic but not asleep. It was possible to rouse him to answer questions in connection with the examination. The pupils were unequal, the right larger than the left, with a delayed light reflex; there was slight palsy of the left facial nerve; whistling was difficult; the sensation of the face was normal and the motor portion of the fifth nerve was not involved. There was no diplopia in spite of the fact that there was an apparent slight external strabismus due to the imperfect action of branches of the third nerve (it is probable that his mental state precluded the recognition of double images). There was some indication of the Cheyne-Stokes type of respiration. The arm reflexes were active and normal and the muscular strength was equal on the two sides. The legs also showed equal strength, with active knee reflexes, no clonus, normal plantar and Achilles response. So far as it was possible to determine, the sensation of the legs was normal. On attempting to walk, the gait was very uncertain; there was complaint of vertigo and of tinnitus in the right ear. A watch was heard at six inches on the left, but there was no air conduction on the right; there was slight bogginess behind the right ear. The heart sounds were normal; the pulse from 44 to 48 and regular in time. The temperature at the examination was 98.6°.

A diagnosis of cerebral abscess was made, presumably of the right temporal lobe, and operation was advised and accepted at once. The mastoid was trephined and no pus found. A secondary opening above the mastoid showed at once a bulging brain, evidently under much pressure. The opening was enlarged and a slight opacity of the pia showed the probable site of the lesion; a probe was passed downward and forward with the immediate effect that a gush of yellow pus flowed out. The opening was enlarged, with the result that more pus was obtained. The pulse was 44 before the operation, 120 to 158 during, and 60 after the operation. The recovery from ether was entirely satisfactory and the patient was left with provision for free drainage. At the end of two days there had been no temperature; the pulse was 60; no paralysis had developed; the pupils were equal in size. He was able to sit up for the dressing and his only complaint was a severe backache. The following day, however, he grew decidedly worse and died twenty-four hours later.

Diagnosis. In the presence of an active suppurating ear with subsequent development of cerebral symptoms of the nature of dullness and disturbance in the cranial nerve innervation, it is safe to make a probable diagnosis of Cerebral Abscess from extension of suppuration through the thin bone into the temporal lobe, or less frequently into the cerebellum. The slow pulse in this case was indicative of increased pressure, although this is by no means a constant sign. Unfortunately no ophthalmoscopic examination was made. A normal temperature should not militate against a diagnosis of a local suppurative process. In abscess of the brain the temperature is often subnormal as well as elevated. It is, however, neither constant in its type nor in any way characteristic. If the lesion, as in this case, is on the right side, it is often difficult to determine between a temporal and a cerebellar localization. If on the left side, in right-handed persons, the appearance of a sensory aphasia is a most important diagnostic sign of invasion of the temporal lobe (Case 72).

Prognosis. In this case, death presumably resulted from an extension of the infection to the meninges, a constant dan-

ger in operations for abscess. In general, if the abscess is sufficiently walled off and drainage is adequate, cure may be expected in a certain proportion of the cases. It is no doubt desirable to extirpate the sac for the purpose of preventing the refilling of the abscess, with ultimate fatal outcome, as shown in Case 72. A complication in the prognosis is the coexistence of a lateral sinus thrombosis.

Treatment. Although it is no doubt possible for cerebral abscess to remain walled off and latent for many years, with a possible final spontaneous cure, this fact should not justify conservatism in drainage, particularly in cases of acute onset. The treatment is essentially surgical, the object being to expose, drain, and if possible to destroy the pyogenic membrane. If the diagnosis of the location is not definite, it is desirable first to expose the mastoid cells with or without tying the jugular veins, then to trephine over the temporal lobe and finally to expose the cerebellum.

Case 74. E., a woman of forty, unmarried, had had considerable headache, especially at night, for a period of about eight months. She had also had some vertigo for a part of this time, but in spite of her ill feelings had gained in weight. She had lived a life of considerable nervous strain; as a child she was not strong and at one time is said to have had a "nervous breakdown." Three weeks before being seen, she experienced a sudden severe pain in her head, with immediate disturbance of vision, which, however, quickly returned. She was able to be about on the following day, but the next night was unable to sleep on account of pain at the back of her neck, on the right side of her neck and in her head. The following days her head remained uncomfortable, and stiffness, associated with pain of the muscles of the right side of the neck, developed. Following this her neck became swollen on the right side and she had extreme tinnitus in her right ear. She had previously had some ear suppuration, but no disabling disorder. About eight days after the onset she vomited several times and had a constant sense of nausea. The head pain grew worse and paroxysmal in character. She described her sensation as if her "head was filled with blood." This pain was associated with defective vision. The vomiting was of transient duration and for several days had given her no discomfort. She noticed, however, that she did not avoid objects properly and that her eyesight was very defective, reaching such a degree that she was unable to count fingers two feet before her eyes. An ophthalmoscopic examination showed edema and hemorrhage of the retinæ, more marked on the right than on the left. There was also slight protrusion of the eyes. The choking of the disks increased, with corresponding reduction of vision. There was absolutely no significant temperature at any time; the pulse varied from 65 to 80 or 90; the urine showed a faint trace of albumin and occasional hyaline casts.

When examined, about two weeks after the acute onset, the patient was difficult to arouse but perfectly conscious. She was a stout woman, lying on the right side in a bent position. The eyeballs were prominent, the left more so than the right. The pupils were equal, with imperfect light response.

There appeared to be some difficulty in movement of the bulbs, especially of the left eye, outward. She was practically blind, with excessive choking of both disks. The cranial nerves were otherwise free from involvement. There was no definite swelling in the neck over the jugular region; the pulse was normal; there was no paralysis of arms or legs. The patient appeared to be growing worse and was evidently suffering much discomfort. The temperature was essentially normal, the oscillation being a degree or part of a degree above and below the normal line. The subsequent history was recovery, with total blindness.

Diagnosis. This case is best explained on the theory of a non-infectious Sinus Thrombosis. The pain, vertigo, swelling of the jugular region of the neck, with subsequent slight protrusion of the eyeballs and rapidly advancing choked disk, constitute a combination of symptoms compatible with a filling of the lateral sinus with subsequent extension into the cavernous sinus. The paresis of ocular muscles finds its explanation in the passage of the nerves through the sinus. The very rapid loss of sight consequent upon a choked disk bears out the theory of local pressure and serves also as further evidence that the essential cause of choked disk is pressure behind the orbit. Although temperature and definite signs of infection usually accompany thrombosis of the cerebral sinuses, it is possible that such a thrombosis may run its course without signs of infection, as in this case.

Prognosis. The prognosis of sinus thrombosis is always grave but not necessarily fatal, even if untreated surgically, as shown by this case.

Treatment. If there is manifest invasion of the lateral sinus the jugular vein should be tied to prevent a further dissemination of the process through emboli. In this case, operation was not indicated, inasmuch as there was evidence that the lateral sinus was free from clot. The outcome justified conservative treatment, since the recovery was progressive and complete with the exception of atrophy of the optic nerves, which presumably could not have been prevented at any stage of the illness.

Case 75. S., a boy of five, who had three healthy brothers and sisters, had been defective from birth. His mother had had no miscarriages and the labor in his case was an easy one. His head was from the first small and his arms and legs not freely movable. At eight months, he had a convulsion which was followed thereafter at varying intervals by others. At two, his legs, which had previously been becoming spastic, became more definitely contractured and finally became crossed under conditions of extreme rigidity. His mental condition was evidently defective and, because of spasticity and contractures both of the arms and of the legs, he was practically helpless.

Examination showed a very poorly developed child lying on his back, moving his head aimlessly from side to side and occasionally bending his back and retracting his head in a semi-voluntary manner. Facial movements were associated with this. The head was small, the hair fine and growing low down on the forehead. The ears were too large, the eyes expressionless, with a tendency to conjugate deviation and nystagmus. The pupils were equal in size and reacted to light. There was a slight degree of internal strabismus. The mouth was open and saliva was constantly escaping. The palate was high and the teeth very defective. Examination of the body organs showed nothing abnormal. The general nutrition was, however, extremely defective; the patient was very thin, with contracted abdomen. The arms were rigid, held closely to the body, flexed at the elbow and somewhat at the wrists, but varying decidedly on the two sides. The reflexes could not be satisfactorily tested on account of the contractures. The legs were crossed at the thighs and were both extremely spastic, contractured and wasted from lack of nutrition and disuse. The toes were in a position of plantar flexion and, as in the arms, were capable of very slight movements. The knee jerks were about normal, no plantar reflex was obtained, either of the flexor or extensor type, and no clonus. The skin, both of arms and legs, was blue and glossy. The mental condition of the child was evidently most defective. He never spoke, paid little attention to what was going on about him, but was capable of fixing his attention momentarily on

objects if directly presented to him. He was fed with difficulty and swallowed only when food was actually forced upon him. Under these conditions he lingered for several months and finally died of general inanition.

Autopsy. The post-mortem examination revealed a very defective brain, as shown in the accompanying sketch. The convolutions were small, abnormally placed and in the occipital lobe of the right hemisphere was a large, porencephalic defect connecting the surface with the posterior horn of the lateral ventricle. In general, the brain showed deficient development in all its parts, the hemispheres being particularly small and not covering the cerebellum. There were secondary degenerations in the motor tracts. The skull was

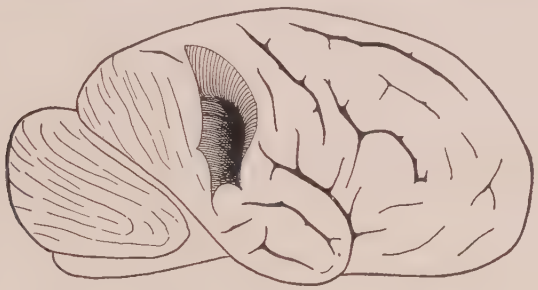


FIG. 32. CASE 75. Defective Brain; Porencephaly.

deformed, corresponding to the defective brain. The pleural cavity on the left was almost entirely obliterated by old fibrous adhesions; on the right, collapsed lung lay against the wall, with various adhesions. The lungs were infiltrated by tuberculosis.

Diagnosis. It was evident during life that the patient was defectively developed, particularly in relation to the nervous system, and also that the condition of the extremities was due to definite brain lesion. This condition is known as Little's disease or Cerebral Paralysis of children. It is characterized, as in this case, by spasticity of high degree, with contractures often leading to crossing of the legs and great difficulty in locomotion. The reason for this condition lies in the faulty development or destruction of the motor neurones of the upper type. The condition is often associated with feeble-minded-

ness and no definite pathological anatomy can be laid down beyond that of general hypoplasia with or without actual porencephalic defect. The condition is not to be mistaken for any other type of cerebral disorder. It is usually congenital and of obscure etiology.

Prognosis. In general, the life of persons afflicted with cerebral paralysis is curtailed. This, however, depends wholly upon the extent of the original damage or failure of development. Therefore, each case must be determined on its merits. The resistance of this patient was extremely low and he fell a ready victim to tuberculosis, although during the latter part of his life under most excellent hygienic conditions.

Treatment. Treatment is essentially unavailing except through the palliation or correction of deformities by surgical means and on the medical side by special teaching adapted to the degree of existing intelligence.

Case 76. N., a girl of five, was seen in December, 1906. Before the present illness, she had been regarded, in general, as a normal child of a somewhat nervous temperament. Ten days before being seen, she had had an unexplained attack of vomiting which had continued for a week; at times this vomiting was apparently of the cerebral type. She had no fever of consequence, and no apprehension was entertained regarding her condition. Three days before being seen, she was found on the floor, having fallen while attempting to get out of bed. Spasmodic movements of the left arm were noticed and a few hours later a paralysis of the whole left side developed, with slight involvement of the face. Since this attack, she had been stuporous, but at times could be roused. Examination of the internal organs showed nothing abnormal. A lumbar puncture revealed clear fluid. The temperature had risen and at one time had reached 106°, falling later to 102° or 103°. At the height of the temperature the pulse was 200.

Physical examination ten days after the onset of vomiting showed a temperature of 102°, pulse between 100 and 120, paralysis of the right arm and leg with marked contracture of the arm, the leg being held straight with foot inverted. The knee jerks were active, the right greater than the left; there was no Babinski sign and no ankle clonus. The Achilles reflex was more active on the unaffected side, doubtless due to the contracture on the paralyzed side. The abdominal reflex was slightly present on the right; not obtained on the left. The pupils were widely dilated, responsive to light, and showed a conjugate deviation toward the right. The head also was held toward the right, but the neck was not markedly rigid and on forced movement did not excite pain. There was no Kernig sign. The child was slightly conscious and played with a watch chain, but refused entirely to obey commands, as, for example, a request to show her tongue. There was slight twitching on the right side of the face and in the right arm. There was no sign of injury to the head as might possibly have been expected as a result of her fall from the bed.

Four and a half months later she was seen again and the following history was given: Six weeks before she had become

nervous, was nauseated and continually said, "I am going to throw up." There was a slight temperature for eight days, but from this she recovered, excepting that there were somewhat more marked convulsive movements of the face and arms. Previous to this there had also been a period of elevated temperature, with some coryza, associated with digestive disturbance, and about four weeks previous to the first of May she had had a period of apparent fright, with heart palpitation. She appeared dazed and was apparently unable to answer questions, although she appeared to know what was said to her. She complained of sore throat, although examination showed none. These attacks had been repeating themselves nightly before going to bed; they were quickly over and she was perfectly calm afterwards. She had had similar attacks in her sleep, when she stood up in bed much frightened, with twitching of the left side. On the whole these attacks had increased in frequency, at times reaching as many as twelve in twenty-four hours. She became increasingly restless, sleep was disturbed, and there was some urinary incontinence, with occasional complaint of headache.

Vomiting did not persist. The twitching movements always began in the left arm. Examination at this time showed equal pupils with good light reaction, no strabismus or deviation. There was a slight left facial palsy, together with slight paralysis of the left hand, arm and leg and athetoid movements of the left hand. The gait was normal except for a very slight limp. The knee jerks were active; no clonus or Babinski could be elicited. The patient was very restless during the examination, had a marked speech defect and showed defect in intelligence. Her curiosity was, however, easily aroused. In general, she had improved physically, but her mental state had shown no such definite tendency. At times she was destructive; she was always happy, never cried, enjoyed her food and was in constant motion.

Diagnosis. The diagnosis of this case presents certain difficulties. Tuberculous meningitis may be excluded because of her relative recovery. Meningitis of other types is unlikely because of the lack of neck rigidity and a clear spinal fluid. Furthermore, the predominant involvement of the cortex,

although by no means unknown in acute meningitis, is unusual. A more likely supposition is that the patient suffered an attack of Encephalitis localized essentially in the right motor area. The primary spasmodic movements of the left hand followed by a hemiplegia lends weight to this supposition. It should be remembered that hemiplegia in children is usually caused by cortical, rather than by capsular, lesions. The secondary epileptiform attacks are consistent with this diagnosis. The analogy of this lesion to poliomyelitis is striking; it is, in fact, altogether possible that the conditions are identical, differing only in the localization of the pathological process.

Prognosis. The prognosis for life in this case is good, but it is probable that the patient will not develop normally on the mental side, will retain some physical defects and may be epileptic.

Treatment. Bromides proved useful in quieting the excitement. Sodium salts should be given in doses of 5 grains, repeated several times a day as needed. Much importance is to be attached to the general care and education of such a defective child in the future. She should not be allowed to go to the public schools except as she may be enrolled in a special class.

Case 77. E., an unmarried woman of twenty-four, employed in a mill, was first seen November 29, 1910. She gave the following history. There was nothing of significance in her family history; she had had children's diseases and four years ago had been operated upon for cystic ovary and prolapse of the uterus. This condition had given her no further trouble. Seven weeks before being seen, she began to notice that objects seemed blurred. A week later she had a sudden severe headache, localized chiefly over the top of the head. She gave up work and went to bed, the headache continuing and extending into the back of her head and neck. The neck became stiff so that she was unable to move her head to any degree for two weeks. During this attack she vomited two or three times a day. About four weeks before being seen, she again had distinct blurring of vision, and considerable tinnitus had developed.

An examination on December 7 gave the following results: There was no disturbance of smell. Vision was markedly blurred and there was sharp pain through both eyes; the pupils reacted to light but not to distance. There was no hemianopsia, but a reduction of the visual field in the left eye was apparent, which at that time appeared normal in the right. There was choking to the degree of several diopters of both disks, the left more marked than the right. The vessels were tortuous, the outlines of the disks gone, and many small hemorrhages. There was palsy of the left external rectus and the right internal rectus with retained slight action of the left internal rectus and the right external rectus. There was no ptosis and she was able to close her eyes tightly. The fifth and seventh nerves showed no abnormality. Hearing of watch tick was possible at one foot in both ears. Bone conduction by tuning fork was heard for sixteen seconds on the left and for twelve seconds on the right. The ninth, tenth, eleventh and twelfth nerves were normal. There was no ataxia of the hands; hand grasp was equal on the two sides and the general muscular tonicity of the arms equal. There was no astereognosis. The knee jerks were obtained only on reinforcement, the right more active than the left. No Achilles, Babinski, Oppenheim or ankle clonus was present.

There was no Romberg sign. The heart, lungs, abdomen and urine showed nothing abnormal. The gait was extremely uncertain, partly, no doubt, due to defective vision.

Intracranial pressure, presumably due to tumor, was diagnosticated and the patient was admitted to a hospital early in December for operation. A right subtemporal decompression was done December 14, under ether anesthesia. The dura bulged through the opening, and, when nicked, a jet of cerebrospinal fluid, under pressure sufficient to throw it twenty centimeters in height, escaped. Attempts to puncture the ventricle failed. The wound was closed without drainage, and an excellent operative recovery followed. Vision improved very quickly, but diplopia remained. On December 24, the disks were fairly well defined and the swelling had largely subsided. A week later, the hernia of the brain had increased in size and vision was greatly improved although far from normal. She was able to distinguish colors and could read to a certain extent. The right eye showed a third vision and the left a sixth. Both disks were plainly visible, there was no swelling, but signs of beginning atrophy were appearing. Two weeks later a cyst had formed over the site of operation, which was tapped, yielding about three ounces of clear, straw-colored fluid, non-infected. Since improve-

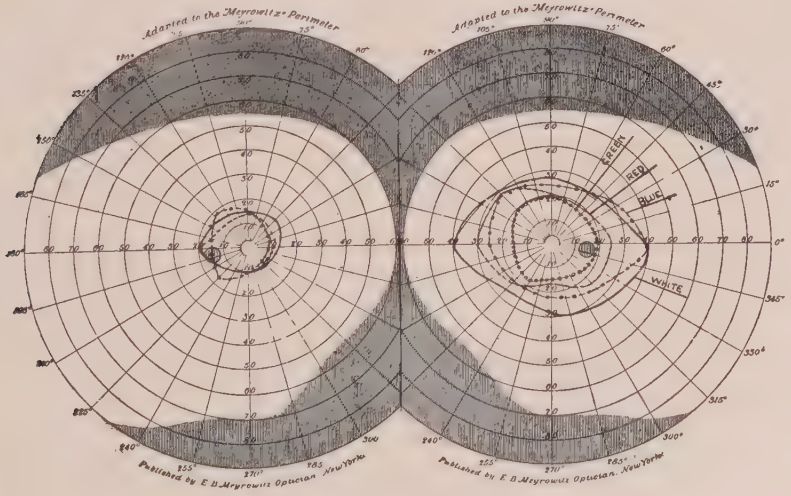


FIG. 33. CASE 77. Visual Fields, February 6.

ment had ceased, a similar decompression operation to the first was done on the left side. The dura was less tense than at the first operation, but there was some bulging. As before, no tumor was found. The dura was replaced and the wound closed. She recovered well from the operation, but her eyesight did not again improve. On February 23, somewhat over two months after the first operation, the statement was made that she had some headache, but had only had one severe attack in the preceding two weeks. She had had no nausea, vomiting or vertigo, and her appetite was good. She could not see well enough to read. She had, in general, been very much more confortable since the operations, with practical cessation of all symptoms and marked temporary improvement in sight. No further operation appeared justified.

Diagnosis. Headache, vomiting, choked disk and vertigo are sufficient always to determine the presence of increased intracranial pressure. In this case, these symptoms were well marked when she was first examined, leaving small doubt that she was suffering from a Brain Tumor, which is, by all means, the most common cause of cerebral pressure. The slight paralysis of ocular nerves should not be given too great weight in focal diagnosis, since general pressure may well produce this degree of disturbance. There were, in this case, no localizing symptoms whatever of diagnostic worth, a very common experience in intracranial growths. The diagnosis, therefore, was Brain Tumor of unknown location.

Prognosis. The tumor in this case developed rapidly, as shown by the increase of symptoms during the few months since they were first observed. This, together with the fact of the high degree of pressure demonstrated at the operations, and the fact that there is no likelihood of localizing the growth, render the prognosis hopeless.

Treatment. Early operation was imperative in this case, if the eyesight were to be saved. The older idea of postponing surgical intervention for several weeks until a thorough antisyphilitic treatment has been given is no longer justified, even if the possibility of determining the presence of syphilis were not at hand through the application of the Wassermann

test. In view of the fact that localization was impossible, the usual right subtemporal decompression was done, with immediate relief of all symptoms and improvement of the sight as already stated. The hope, in the second operation, was that the pressure might be still more reduced by a further opening of the skull, and that conceivably the tumor might ultimately give indication of its location. It is evident that the disturbance in the optic nerve through pressure had gone on too far to permit of complete restoration of sight. In general, the decompression operation should be undertaken as soon as possible after the first sign of optic nerve disturbance has appeared.

Case 78. U., twenty-nine years old, foreman in a factory, had been married five years and had had two children. There was no indication of present or former venereal disease, and his habits were, in general, good. Beyond headache, which he had had for years, he had had no illness of significance. Seven months before he was examined, which was on April 18, 1903, he had undergone an attack of what was called influenza. He was confined to his bed and made a poor recovery, with persistent, chiefly frontal, headache, which had continued of about the same violence, but with temporary exacerbations. The pain was the same day and night, and for a very considerable time was not associated with vomiting. The latter part of March, he gave up work, because of increasing general weakness. A week later he noticed numbness in the right hand, shoulder and face, and at about the same time a sudden weakness of the right hand developed. The weakness persisted; the numbness improved. Beyond slight pain in the calf of the left leg, the legs were at that time in no way involved. He had worn glasses, but his eyesight he thought not impaired by the present illness. He had noticed some unsteadiness of gait. The urine showed no abnormality. He had felt tired and drowsy and slept well. His appetite also remained satisfactory. He had, however, lost nearly thirty pounds in weight, and twelve during the past three weeks. There had also been a constant though irregular elevation of temperature for several weeks, the exact character and extent of which had not been systematically observed.

Physical examination at the first visit (April 18) was as follows: Right pupil slightly larger than the left; no defect in light reaction or with accommodation; no palsies of any cranial nerves, with the possible exception of very slight involvement of the right facial; slight thickness of speech, which came on with the arm weakness, but difficult sentences were correctly repeated; no mental defect beyond slight apathy. General sensibility of the hand was normal, with the exception of well-marked astereognosis. The movements of the hand and arm were exceedingly weak and the hand muscles almost completely paralyzed. There was no

pain over the nerve trunks. The arm reflexes were active in both sides and showed no decided inequality. There was a very slight Romberg sign but no abnormality of the legs or feet, sensory or motor. The knee jerks were active, but within normal limits; Achilles jerks present; no Babinski. The pulse was 140, with correspondingly rapid respiration.

On April 21, three days later, it was reported that he had had attacks of nausea and vomiting for some time, but apparently associated with the taking of food, and not projectile in character. On that day he had had a distinct spasm of the right hand and arm. His wife stated that he had grown irritable and unreasonable. The pulse remained rapid. There was possible exceedingly slight impairment of tactile sensibility of the right hand. The astereognosis was complete as before. There was no recognition whatever of various objects placed in the hand, as, for example, a watch, a small box, a fifty-cent piece. *Electrical examination* gave satisfactory response to faradism from nerves and muscles; galvanism, quick response; CaC greater than AnC; no indication of R. D. and no noteworthy difference on the two sides in the muscles examined. The right hand and arm were almost completely paralyzed. Pupils dilated with hematropine showed marked physiological cupping; unusual arrangement of vessels; outlines of disks for the most part clear but somewhat clouded on the nasal side of right eye; no hemorrhage and a suspicion merely of beginning choking. The vision was unimpaired. Iodide of potash was given in increasing doses but without effect.

The following further points of interest developed: Spasmodic movements of the face, on both sides, with temporary loss of speech, but without marked involvement of the leg, and many spasms of the right hand, lasting about an hour, supervened. The abdominal reflex became greater on the left than on the right; the knee jerks, greater right than left; there was marked ankle clonus right, none left; plantar reflexes were present and apparently normal. Muscle sense of toes was unimpaired, but astereognosis of the right hand persisted. The temperatures had remained elevated; respiration, 36; pulse, 136; blood pressure, 140. There had been

diarrhea for several days, with rapid change for the worse in the past two weeks; he became very weak. The leucocyte count was 12,000. Further examination of the chest showed no definite signs of disease. The tuberculin test was not attempted on account of persistent elevation of temperature.

Operation. The skull was opened on May 1, over the right arm area, extending also posterior to the central fissure. A tumor was at once disclosed and in large part removed, chiefly anterior to the fissure. The tumor appeared to be semi-encapsulated; the temperature at the operation was 103.5. Immediate recovery from its effects was satisfactory; there was no vomiting at any time. Subsequent examination showed the right pupil larger than the left, with adequate light reaction on both sides; there was much difficulty with speech, of the motor type; the right arm was completely paralyzed, and the right leg partially so; the knee jerk was greater on the right; there was Babinski sign and ankle clonus.

FIG. 34. CASE 78. Showing Location of Tumor Productive of Astereognosis.

There was temporary improvement in some of these symptoms, but in general the patient gradually failed. The sensibility of the right arm was as before the operation, and the astereognosis persisted. There was some bulging of the returned

bone flap but no signs of sepsis; the temperature remained elevated. He died May 28, four weeks after the operation.

Autopsy. The autopsy revealed general miliary tuberculosis involving all the internal organs, with a primary focus in the prostate or seminal vesicles. The brain tumor was also tuberculous in character, with several small adjoining but discrete tumors in its immed ate neighborhood.

Diagnosis. A definite diagnosis of tuberculosis, though strongly suspected during life, was not made. The temperature was highly suspicious, but it was difficult to bring it into immediate connection with a well-defined and localizable brain tumor. That so large a tuberculous mass should have been present with an acute miliary process is a matter of interest. The motor weakness of the right arm, together

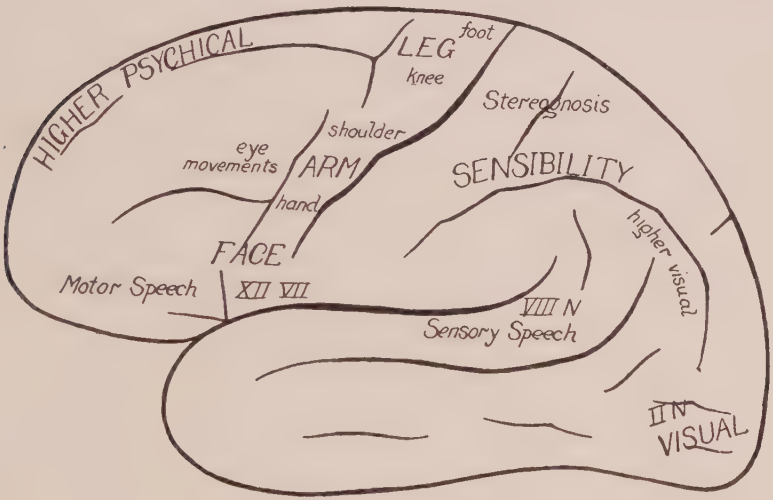


Fig. 35. Cortical Areas.

with a perfectly developed astereognosis, pointed strongly toward a lesion of the arm area of the left cortex, presumably extending backward into the sensory zone. (See Fig. 35.) This assumption was justified both by the operation and by the autopsy.

Prognosis. In view of the generalized tuberculosis, the prognosis of the case was hopeless. It is not probable that the operation influenced in any way his length of life.

Treatment. In so sharply localized a lesion, operation was justified, even in the presence of temperature, which, although unlikely, it was conceived possible might be due to an independent cause.

Case 79. R., a man thirty years old, the father of two children, had had typhoid fever but in general had been well. He noticed no difficulty until about six or eight months before being seen, in October, 1907. He had had no nausea or vomiting but had had some little difficulty with gastric digestion, accompanied by a sense of burning and a feeling of weight. About four weeks before being seen, while driving in an automobile, he noticed a sense of irritation in the right eye, which was attributed to dust. The sensation so originated seemed, however, to spread about the eye and persisted. Later, this became a feeling of heat extending over the right side of the face and over the upper arm. He also occasionally had disordered feelings in the right hand. Four days after the onset of this disturbance, there was a rapid development of left facial paralysis. A week later, the mouth was completely paralyzed on that side. There was also further extension of the area of disturbed sensation involving the upper part of the chest. On more than one occasion there had been a severe " cramp " in the paralyzed side of the face. A paralysis of the left sixth nerve had also developed during a period of two days. There was no diplopia, but the patient had long since learned to ignore the right eye, owing to a former squint which had been surgically corrected. He had had absolutely no headache, but had observed some vertigo when his head was tipped back, and unsteadiness in standing, particularly when he attempted to turn quickly. He had no further feeling of discomfort beyond what he described as " a disagreeable taste in the mouth." He had noticed no disturbance of hearing.

Examination showed no changes in the fundus (the left eye only examined); there was practically a complete paralysis of the left external rectus; the muscles supplied by the third nerve were unaffected; there was a complete paralysis of all muscles supplied by the left seventh nerve, including the platysma. The nerves below the pons were unaffected. On the right side, involving one half the head, the shoulder and upper arm, the skin was paresthetic, with some objective blunting of sensation. There was no pain whatever over the nerve trunks. The knee jerks were active and normal;

wrist jerks were slightly present; the abdominal reflexes were active.

When seen about three weeks later, he had lost power in the left masseter muscle (supplied by the fifth nerve). One half the tongue, the gums and the left cheek also had become numb. This had come on in the course of two days. Taste was somewhat affected on the left side. For several nights there had been considerable pain over the left mastoid bone, throbbing and intermittent in character. There was an especially tender spot under the left ear, but the entire side of the face was sensitive to touch. There had been no ear suppuration. Since the previous visit he had had considerable nausea on two occasions after eating, and also in the morning on rising. His stomach had been out of order for two weeks, and he had given up iodide of potash, which had been prescribed. He had been languid, physically weak and had lost weight. There still was no definite headache, and some improvement in the movement of the left masseter was noticed.

Physical examination at this time showed weakness of the right internal rectus (third nerve). The globe could not be moved beyond the middle line. There was definite weakness of the left masseter. Contraction was still possible but markedly less than on the right. The jaw could not be moved beyond the line of the teeth toward the right (pterygoids). The whole sensory distribution of the fifth nerve was blunted on the right side, with a further extension of disturbed sensation as before noted. The gums and inside of the mouth, together with one half the tongue, remained numb. There was reaction of degeneration in the paralyzed facial nerve. The palatal reflexes were lacking; there was distinct vertigo when he tipped his head backward. Examination of the facial nerve showed slight faradic response on direct and indirect stimulation, with slow response to galvanism, the CaC greater than AnC; partial R. D.

One month later, the areas of disturbed sensation extended over the whole right side, involving the foot. He vomited regularly every morning before breakfast and was somewhat nauseated. The nausea was worse when lying down. He

had no headache whatever; his gait was increasingly uncertain and he thought he staggered especially toward the right. The optic disks remained absolutely normal and, in general, his eyes had not changed. There was still conjugate deviation toward the right; reaction to light was normal. Taste was not properly appreciated on either side of the tongue; smell was unaffected; the reflexes were in general active; there was no definite Romberg sign; he had been extremely weak and had lost probably fifteen or twenty pounds. He died, March 22, 1908, with the development of a paralysis of the sixth, seventh and eighth nerves, associated with considerable ataxia and final throat involvement.

Autopsy. The autopsy in this case revealed an extensive non-infiltrating Tumor of the dorsal portion of the pons throughout a considerable part of its extent. The growth did not give rise to any marked distortion or increase in size of the region of the brain stem involved. Histological examination showed the tumor to be a sarcoma.

Diagnosis. The signs in this case all pointed toward a lesion, progressive in character, of the right side of the pons. The fifth, sixth, seventh and later the third nerve of that side were involved. Of importance in the diagnosis of pontine lesions is the conjugate deviation of the eyes, markedly present in this case. It is of special interest that throughout the course of the disease the intracranial pressure was so slightly raised that choked disk did not occur. Headache, also, was not a conspicuous symptom, and vomiting was not extreme, certainly not until toward the end of life. In general, tumor in the posterior fossa gives rise to early choked disk, headache and vomiting. Their absence in this case was due to the infiltrating character of the growth.

Prognosis. Operation was not seriously considered owing to the position of the growth and to the consequent impossibility of its removal.

Treatment. Treatment was unavailing.

Case 80. O., a teacher of forty-three, gave the following history. Two weeks before being seen she suddenly slipped on a waxed floor and fell, striking her face on the right side without having extended her arm to break the fall. She sat up at once but was dazed and unable to stand. How she happened to fall, beyond what has been stated, she could not remember. She was finally able to go down a flight of stairs alone. There was slight bleeding from the mouth through a superficial cut. She was not nauseated, gradually became less confused and soon felt decidedly better. A swelling about the size of an egg developed at the point where she struck, but this did not interfere with her sleep that night. The next morning she considered herself well. She had little pain and the swelling had begun to subside. She was able to do some typewriting, and had no headache during the day. At the end of a week, except for some head pain in the morning, she suffered no discomfort. Six days after her fall she had a very exacting day and the following morning awoke with an extremely severe headache, chiefly in the left frontal region. She was faint and vomited after breakfast. The pain continued the following day, but she was able to go out. Several days later, headache became persistent, extended over the vertex and was sufficiently severe to give her considerable discomfort. She had formerly had migranoid headaches very infrequently. Of late, they had returned at shorter intervals. She had begun to worry considerably over her condition and feared her memory was failing.

On the supposition that her condition was a very natural result of the experience through which she had passed, a rest away from her work was advised. Following this suggestion she went to a seaside place, but at once grew worse. Headache was extreme and considerable confusion of speech developed. She returned to Boston in a deplorable condition, hardly able to walk or speak and evidently extremely ill. She was at once sent to a hospital, where the following conditions were noted.

She had developed extreme difficulty in expressing herself, and at times appeared almost delirious. The pulse was regular and rather slow, 60. She sank rapidly into a stuporous

state, with incontinence of urine. She could be roused only with the greatest difficulty and then only for a brief period. Occasionally, she shook her head in answer to a question and showed some slight sign of recognition of her situation. In general, she lay with eyes closed and apparently entirely indifferent to her surroundings. On raising the lids, the eyes were expressionless. The pupils were not widely dilated and reacted properly to light. She did not protrude her tongue on request. The temperature became slightly elevated and the pulse varied from 54 to 60 and was of good quality. After being two days at the hospital, spasmodic movements of the right arm and hand developed. These were intermittent and associated with much rigidity, the fingers being tightly pressed into the palms. Both legs were continuously moved, but not spasmodically. An examination on the evening of that day showed the arm reflexes all active, probably more so on the right than on the left. The abdominal and epigastric reflexes were not obtained on the right side. The knee jerks were both very active, with double clonus and marked Babinski response. On the right there were athetoid movements of the toes. This was also noticed in the right hand, together with much tremor simulating a clonus when any movement was attempted. At this time the patient was very restless and delirious. On account of her incapacity to fix her eyes, a fundus examination was extremely difficult, but a choked disk in both eyes was strongly suspected.

Operation was decided upon. A large osteoplastic flap was laid back on the left side, including the motor area. The dura was under high tension. An incision led to a slight escape of serum, but no blood. A trephine on the opposite side showed the same condition. No hemorrhage was revealed. The coma was so deep that a small amount of ether only was necessary for anesthesia. The pulse during the operation was from 90 to 120. The temperature was somewhat elevated, but in general the recovery from the operation was satisfactory. During the following night she was able to swallow, but the temperature rose to 103+. The following morning it went down to 101°, with a pulse of 132. There were slight signs of returning consciousness, with twitching of the lids and move-

ments of both hands, the left more than the right. The improvement was, however, merely temporary, and she died three days later without recovering consciousness.

Autopsy. The autopsy revealed no external hemorrhage whatever, either on the convexities or on the base of the brain. Section revealed a large infiltrating tumor occupying the

FIG. 36. CASE 80. Showing Location and Extent of Tumor.

greater part of the left temporal lobe. The growth was vascular, hemorrhagic in some places and necrotic in others. There were adhesions of the dura over the tegmen tympani, but without evidence of disease of either ear.

Diagnosis. A definite diagnosis in this case was not made. The entire absence of symptoms in the history pointing to intracranial pressure together with a violent fall, striking the head, led to the supposition that the patient was suffering from the immediate effects of this violence and that her later symptoms were due presumably to a hemorrhage indirectly resultant therefrom. The facts of the case probably were, that the Tumor had existed for several years, had been so infiltrating in character and insidious in onset and had given rise to so little pressure that the general symptoms of tumor had not developed. When the patient fell, the absence of injury to her hands undoubtedly signified that she was unconscious at the time and that the fall was a consequence of the attack which suddenly came on. The injury resulting very probably led to certain hemorrhages in the vascular tumor and undoubtedly precipitated the onset of the fatal

outcome. The case illustrates the now well-recognized fact that tumors of the brain, if lying in silent areas, may exist for long periods without giving rise to signs or symptoms, and also that trauma may precipitate a fatal outcome under such conditions, though not in itself to be regarded as causative of tumor formation. The final symptoms were undoubtedly due to general pressure leading to spasmodic movements of the opposite side of the body, choked disks and stupor. The primary supposition when the operation was undertaken was that hemorrhage might be found. Tumor was considered a wholly unlikely explanation of the condition.

Prognosis. The condition as revealed by autopsy was entirely irremediable.

Treatment. The treatment is sufficiently indicated in the foregoing description.

Case 81. L., a young man, twenty-two years of age, was admitted to a hospital July 19, 1901. He was unmarried, and by occupation an expressman. His family history was negative except that his mother had suffered from some sort of paralysis and was unable to walk for a time previous to her death. In April, 1901, he was treated at a hospital for an unascertained disease. He remained for four weeks, leaving the hospital, he thought, well. About a week before his final entrance to the hospital, in July, the patient stated that he was found unconscious in a field and was taken home and put to bed. He thought that he was more or less unconscious for a week, and knew only what was taking place in that time from what was told him. His family informed him that he talked and answered questions during this week of apparent unconsciousness. When he regained consciousness, he found his sight impaired, and it failed rapidly thereafter, until finally he could only distinguish light from darkness. He complained of severe headache, which had been present since this attack. The foregoing statements are not to be regarded as entirely satisfactory on account of the mental condition of the patient. He answered questions quickly on being aroused, but his statements did not always agree. His mental state varied from time to time.

Physical examination after entrance to the hospital showed a well-developed man of moderate intelligence. His pupils were dilated, reacted sluggishly to light, but did not accommodate. There was no paralysis of the ocular muscles. The tongue was heavily coated and there was much sordes. The heart was normal; the pulse, 45. The lungs showed no abnormalities, nor did the abdominal organs. There was no Babinski phenomenon or clonus, and no loss of sensation or motion discoverable. The urine was negative. During the following month the patient remained in a semiconscious condition; he could be aroused, but made contradictory answers to questions asked. Headache and vertigo persisted, and there was almost daily vomiting in spite of the maintenance of a good appetite. No paralysis was discovered during this time. On August 6, there was a choked disk of the right eye of about 2 millimeters elevation; the

vessels were very tortuous. The left eye showed complete optic atrophy with arteries of small caliber. On August 9, mental confusion regarding place and time manifested itself, with somewhat less headache. On August 30, a left internal strabismus appeared, which was the first possible localizing symptom. There was also a questionable paresis of one seventh nerve, with very slight numbness of the left side of the face. Hearing and the other cranial nerves showed no involvement. Knee jerks and plantar reflexes were normal. At this time it was noticed that the swelling of the nerve head in the right eye had greatly diminished; the outline of the disk could be faintly made out and the disk had a distinct, glossy, white color; the vessels were less tortuous. The pupils no longer responded to light, and there was no light perception in either eye. From this time on the patient grew steadily worse, with periods, however, of temporary improvement. On October 23, he had a convulsion which lasted about five minutes, without loss of consciousness. On November 1, he was stuporous. Iodide of potassium had had no effect upon his condition. On February 4, it was noticed that convulsions were occurring more frequently, and that each was more severe than the preceding. During these attacks, the patient vomited food which had been improperly masticated. On February 15, he had a severe convulsion; he perspired freely; the breathing was stertorous; tonic and clonic spasm developed, but with a satisfactory pulse. The convulsion subsided gradually under ether. If touched, another convulsion was excited. From this time on to his death, which occurred on March 2, there was a recurrence of convulsions, deepening coma, final high temperature (106.2°), with pulse of 140, and death quietly in spite of vigorous stimulation.

Autopsy. The left pleural cavity was completely obliterated by old fibrinous adhesions. The lungs were distended and contained various small hemorrhagic areas. The spleen, stomach, intestines, pancreas, liver and kidneys showed nothing abnormal. The skull was thin; the dura not adherent. At the base of the skull in the middle line, occupying the region of the pituitary body, was a tumor which also involved the

optic chiasm and apparently originated from it. The optic tract on the right side was grayish-white and of normal appearance; on the left, translucent. The tumor was about the size of an English walnut, 4 x 3 centimeters in diameter. The arteries at the base were normal. Both lateral ventricles were greatly dilated, due to pressure by the tumor in the neighborhood of the foramen of Munro. The anterior portion of the third ventricle was obliterated, leading to compression of the choroid plexuses. The left optic tract was apparently destroyed by the tumor. The right optic tract was markedly involved at one point, though not completely obliterated. The third nerve showed no involvement on either side. In the specimen as finally received for examination no further statement was to be made regarding the cranial nerves. On section, the tumor consisted of a larger cyst about one centimeter in diameter, and many smaller cysts filled with a coagulated, translucent mass. In the solid portion which comprised the remainder of the tumor there were a considerable number of fresh hemorrhages.

Microscopic examination showed a highly cellular, new growth, interspersed with many new-formed blood vessels and cysts. The arrangement of the cells was irregular and without a definite stroma. The cells composing the growth were round, with many transitional forms toward the spindle variety. The growth should be included under the sarcomata.

Diagnosis and Remarks. The diagnosis of Tumor in this case was not difficult, owing to the manifest signs of intracranial pressure. Its location was less simple and in fact was not definitely determined during life. The points of special interest in the case are: (1) The mode of onset and the mental state of the patient; (2) the occurrence and significance of early optic nerve atrophy; (3) convulsions and their significance; (4) the slight involvement of cranial nerves other than the optic nerves; (5) the tendency to remission of symptoms; (6) the presence of a tumor in the neighborhood of, and probably involving, the hypophysis, without the production of acromegaly.

The case shows that the signs of tumor may come on suddenly (see also Case 80), and that marked mental disturbance

may occur as a result of tumor far removed from the cortex. The early optic nerve atrophy often indicates pressure directly upon the optic nerves or tracts. The small localizing value of convulsions is demonstrated by this case. That acromegaly did not develop is no doubt due to the fact that the prehypophysis was not involved.

Prognosis and Treatment. Had a diagnosis been made, the prognosis was in any event hopeless, since removal of the tumor was impossible.

Case 82. O., a boy of five and a half, was a second child. There was no difficulty at his birth and he appeared normal as an infant. At the age of two, he had a convulsion from which he quickly recovered. Since that time there had been difficulty with digestion. When he was about three and a half years old he began to complain of his head, which appeared to be painful; the attacks of pain, however, were of very transient duration and were always relieved by vomiting. A year later he had many attacks characterized by sudden retraction of the head, followed by screaming. He was irritable and finally had a severe general convulsion, followed by others of slighter degree. He was, in general, slow in development and had not learned to dress himself or completely to control the sphincters.

Examination showed the circumference of the head to be twenty-one and a quarter inches. The distance between the parietal eminences was ten and a half inches; from the glabella to the inion, fourteen inches; the forehead, especially over the eyes, was particularly prominent and the whole head, as shown by the measurements, was large. The eyes gave a good light reaction; there was a very slight internal squint. He was clumsy and ataxic in his movements and walked with a marked ataxic gait. The knee jerks and plantar reflexes were normal. He had, when seen, for sometime been free from convulsive seizures. The heart showed no abnormality.

Diagnosis. This is a backward child of the Hydrocephalic type, as shown by the disproportionate size of the head, associated with manifest defects of development.

Prognosis and Treatment. The child should live to adult life and with proper training should be able to care properly for himself. The epileptiform seizures should be controlled by the bromides, attention to diet and strict hygiene. Nothing can be done to alleviate the hydrocephalus itself, which undoubtedly, in this case, has reached such a degree that the brain is unable to perform its functions properly. There is, however, little reason to fear an increase of the hydrocephalus. An equilibrium has probably been reached which is rarely the case when the process begins at or about birth.

Case 83. G., a man of fifty-nine, six months before being seen had noticed diplopia due to an external strabismus, the left eye being affected. One month later, the left eyelid began to droop. This was followed by a similar drooping of the right lid. He was otherwise well and had no headache, vomiting or muscular weakness. His habits were good; he did not use alcohol or tobacco and denied venereal disease.

Examination showed ptosis of the right lid with the same condition in less degree on the left. The third, fourth and sixth nerves were all involved to a certain degree in both eyes, which led to a practical immobility of the eyeballs. Diplopia was particularly marked on looking forward or upward, the false image being above and to the left of the true image. The pupils reacted normally to light. The knee jerks were present and equal; there was no ankle clonus, Babinski sign or Romberg. The urine showed no albumin or sugar. The tongue, lips, face and palate were not involved.

Under alternating treatment with strychnia and iodide of potash, there was distinct improvement. Somewhat over a year after being first seen, he was able to open his eyes more effectually, the right eye being less involved than the left. Movements of the left eye downward, upward, inward and outward were limited in extent. The same was true of the right eye on attempted downward and inward motion. The movements upward and outward were, however, practically normal. A year later there was further slight improvement, but the movements of the left eye remained affected. There was no extension at any time to other cranial nerves or to more distant parts of the nervous system.

Diagnosis. This is a case of chronic Ophthalmoplegia of unknown etiology. There was no evidence that the patient had suffered from any acute infection immediately preceding the onset of the ocular trouble nor had he been addicted to the over-use of alcohol. There was also no evidence in the face of his denial that the difficulty was due to syphilis. It must, therefore, be assumed that the lesion in this case was an involvement of the ocular nerves, sparing, however, those branches which regulate the pupillary reactions. This affection corresponds in a general way to the progressive

muscular atrophy of the lower cranial nerves (see Case 84), differing, however, in the fact that it has not been steadily progressive and has yielded at least in a certain degree to treatment.

Prognosis. It is not probable that the affection will spread beyond its present limits. Improvement is likely to be maintained, but complete restoration of function is improbable.

Treatment. It is difficult in this case to say whether the treatment instituted was efficacious or whether the improvement resulted from purely natural causes. Iodide of potash was administered for considerable periods up to 150 grains a day. Strychnia was also given in vigorous doses. The improvement seemed to be equally marked under either form of medication.

Case 84. I., a man of fifty-one, a painter by occupation and the father of five children, had noticed for about a year "twitching" of the right arm and later of the left arm, associated with weakness in the use of the hand. Coincident with this, indistinctness of speech developed, which had grown progressively worse. For from three to four months he had had difficulty in swallowing "even water." He had had no pain or feelings of numbness. He had also noticed increasing incapacity to control emotional expression. He laughed and wept frequently without cause. Other than in the respects stated he had been well except for a possible lead paralysis some six years before.

Examination showed the pupils normal, both to light and on accommodation; optic disks clear; no paralysis of the ocular nerves. Both facial nerves were distinctly weak in all branches. The trigeminal nerve was normal. The tongue was protruded with great difficulty and imperfectly. It was soft, atrophic and showed much fibrillation. Speech was almost unintelligible because of the imperfect movements of the tongue. Swallowing was difficult and the muscles of the throat weak. The jaw jerk was active. The muscles of the arms and shoulders were in continual fibrillation; movements, however, were possible, except in the hands, where all motion was imperfect. The muscles showed distinct atrophy. The arm reflexes were active, especially at the elbow. There was no disorder of sensation. The legs were practically uninvolved; the knee jerks were active; there was no clonus; normal plantar and Achilles reflex; there was no Romberg sign. Sensation of the feet and legs was normal. The heart showed no murmurs or enlargement; the pulse was 92; pressure, 120.

Diagnosis. This patient is suffering from Progressive Bulbar Paralysis of the spastic type (amyotrophic bulbar paralysis). The identity of this condition with progressive muscular atrophy of the spastic type (amyotrophic lateral sclerosis) is evident. The process in this case invades primarily the bulbar nuclei or affects them simultaneously with the cells of the cervical ventral horns. The symptom-complex is, therefore, determined solely by the point at which the de-

generation of the nerve cells begins. If the lesion be confined to the bulbar nuclei, the resultant condition is a simple progressive bulbar paralysis. If, on the other hand, as in this case, bulbar nuclei and the cervical cord be simultaneously or progressively involved, a combination results leading to a progressive muscular atrophy of the spinal type, associated with bulbar paralysis. The pathological anatomy of progressive bulbar paralysis is similar to that of the spinal type, namely, primary disintegration of peripheral motor neurones and, if associated with degeneration of the pyramidal tracts, giving rise to the spastic variety of the disease.

Prognosis. The outcome is invariably fatal, death usually resulting from paralysis of deglutition and consequent starvation.

Treatment. It is possible that the disease may be checked somewhat in its course by the liberal administration of strychnia. It should be given to the point of toleration. In this case, lead poisoning may have been an exciting cause. The withdrawal of lead, however, at the stage of the disease when the patient was seen, although desirable, would not materially affect the progress of the degeneration. Solid food and liquids are both swallowed with difficulty in paralysis of the throat muscles and recourse must therefore be had to semi-solids, such as custards and the like. In the later stages tube feeding is possible but of doubtful utility since it merely prolongs a pitiable condition of inevitably fatal outcome. This is also true of rectal feeding.

Case 85. C., a woman of sixty-two, had been well up to the preceding summer. During the succeeding winter she had suffered somewhat from nausea, vertigo, and a sense of falling backward when she lay down. Her appetite was, however, not affected. For a year past, a peculiarity of gait had been noticed, marked by uncertainty and swaying. Her vertigo was of the type in which external objects seemed to move. She was seen by an aurist, who regarded the condition as a Ménière's complex. The ear was blown out and she was distinctly helped. Her hearing improved for a time, the vertigo was better and the nausea disappeared. The right ear became deaf, but she still had fairly good hearing in her left. Later, the gait grew very much worse, with constant sensation of falling backward. She did not, however, lose consciousness and at no time had convulsions or distinct loss of speech. She slept well. Of late she had had some difficulty in swallowing and liquids were likely to regurgitate.

On physical examination the pupils were in no way remarkable; on attempting to fix the eyes laterally, nystagmus developed, and a certain lack of agility in movement became apparent. The fundus was not sharply seen on the right but the vessels were perfectly clear on the left. The sensation of the face was normal; there was no disturbance in the motor portion of the fifth nerve; a slight right facial paralysis was evident; winking was imperfect on that side, although, in general, voluntary movements were preserved. She complained that her food tasted bitter. Speech was slightly thick, but movements of the tongue were apparently free and the muscles were not definitely atrophied. There was no paralysis of the palate, but swallowing was occasionally difficult, as before stated. The strength of the arms was adequate; there was a very slight ataxia and a complaint of numbness of the left hand. The knee jerks were active; the plantar reflexes normal; no clonus. General sensation and the sense of position were unimpaired. There was much Romberg. She walked very unsteadily and with evident constant fear of falling. The heart showed no abnormality beyond an accentuated second aortic sound. The pulse was rather rigid, 84; the blood pressure, 195. In general, the patient looked

feeble, emaciated and sclerotic. The bodily functions were satisfactory.

The patient died seven months later. She failed slowly; was obliged to remain in bed through loss of strength for the last three months. For two months her speech became almost unintelligible. Saliva flowed constantly from her mouth and she had much regurgitation of liquids through the nose. The immediate cause of death was edema of the lungs.

Diagnosis. The most probable explanation of the symptoms in this case was a general Arteriosclerosis with special localization in and about the brain stem. The aural disturbance is no doubt to be explained on the basis of arterial changes, and the final Bulbar Paralysis is to be regarded rather as a result of arteriosclerosis than as a primary degeneration of bulbar nuclei as illustrated in Case 84.

Prognosis. This patient lived less than two years after the first onset of definite symptoms. The length of life varies widely in different cases, but the ultimate outcome is fatal in cases of gradual onset.

Treatment. Small doses of iodide of potash, 5 grains t. i. d., were given in the hope of relieving the sclerotic condition. This treatment, though no doubt harmless, must be regarded with considerable skepticism. Other than that and the treatment of the ear, general care sufficed to render the last months of her life reasonably comfortable.

Case 86. A., a man of sixty-two, leading a life of leisure, had been well up to seven years before. At that time he had an attack similar to the one about to be described, but not so severe, from which he recovered completely but somewhat gradually. He had thereafter considered himself in general well. Four days before being seen he fell from a ladder and had remained in the house since, although he sustained no material injury. The following night he felt as usual. The day before, he noticed, however, that he was not entirely normal and early on the day when he was seen he had "a peculiar sensation in the throat," as he expressed it, without pain. There was no headache. He was seen in a hour by his physician, who noticed a distinct defect in speech, although he was quite able to make himself understood. A few hours later, however, he was unable to talk at all, but with retained capacity to write and with a perfect understanding of what was said to him. His kidneys had been normal.

When examined, the right pupil was irregular in outline, dilated, with inadequate light reaction. There was some power of accommodation; the fundus was not examined. The ocular movements were unimpeded. There was slight right facial paralysis involving the upper branch as well as the others. The hearing was unaffected. Swallowing was accomplished with difficulty and with a tendency toward regurgitation. The tongue was protruded well in the median line and except for finer movements appeared normal. His speech, however, was exceedingly defective, although he was able to find his words and apparently had no difficulty whatever in comprehension. He wrote by preference and with perfect correctness. There was a strong tendency to laugh without provocation. The arms showed excellent strength, without ataxia or sensory disorder. The right wrist jerk was possibly slightly greater than the left. The abdominal reflexes were present. Except for an old injury of the right leg, the legs were normal in strength and sensation. The knee jerks were active, there was no clonus and a slight normal plantar reaction. The heart showed no abnormality beyond a definite accentuation of the second aortic sound. The pulse was small; the radial arteries high; the rate, 72. The

subsequent history of the case was immediate and continued improvement, resulting in an excellent recovery with very slight speech defect. This was within two weeks after the foregoing examination.

Diagnosis. The relatively sudden onset of speech disturbance, together with difficulty in swallowing and slight peripheral disorder in the distribution of one seventh nerve, justifies the diagnosis of Acute Bulbar Paralysis. The speech defect in itself was sufficient to differentiate the condition from a true aphasia or a true aphonia. In the latter case paralysis of the vocal cords would have been in evidence, and in the former the defect of speech would have been characterized either by a failure to understand (sensory) or by a difficulty in choosing words to express ideas (motor). Neither of these conditions were present. The difficulty lay rather in the management of the tongue and of the peripheral organs of speech. The diagnosis of a lesion of the oblongata, presumably on a vascular basis, is further borne out by the associated difficulty in swallowing (vagus-glassopharyngeal group) and the evident existing arteriosclerosis.

Prognosis. The outcome, as stated, was rapid recovery. He had, however, had two attacks, the second more serious than the first; others may naturally be expected.

Treatment. The treatment consisted in attention to the vascular system through gentle stimulation of the heart. In such conditions over-exertion is to be definitely prohibited.

Case 87. L., a married woman of forty-three, had had three well children and no miscarriages. For about a year she had suffered from unusual fatigue, but in spite of this considered herself well. Eight months before being seen, she had waked in the morning with diplopia due to a sudden internal strabismus. She recovered from this at the end of about five months. For the past three or four months, she had noticed, as she expressed it, weakness of different parts of the face, especially on the left side. A difficulty in using her mouth properly began about two months before she was seen. This increased and for three weeks she had not been able to eat solid food and had found it comfortable to support the lower jaw by a bandage. Swallowing had not been affected and there was no regurgitation of food. She had had much paresthesia of the face, — hot and cold sensations, with pain through the forehead, face and occiput. Her head had felt as if "covered with a cap." In general, her strength had decreased. Her appetite, however, remained satisfactory; she was constipated but not more so than ordinarily, and restless at night.

Examination showed a well developed and nourished woman. Her pupils were equal, normal in outline and reacted well to light and on accommodation. The sense of smell (menthol and cloves) was diminished on the left side. Taste was also very much impaired on the left half of the tongue in the anterior portion (quinine and sugar). Hearing was deficient on the left. A watch was not heard when close against the ear, and both air and bone conduction were reduced. The tongue was protruded slightly to the right and its movements were imperfect and retarded. The mouth could be opened satisfactorily but not closed with ordinary strength. There was also slight involvement of the spinal accessory nerve. The eye movements were normal and the fundus showed no change. The striking paralysis to which special attention should be directed was that of both fifth and both seventh nerves. All the branches of both facial nerves were involved to such a degree that the face was wholly expressionless, and practically no voluntary movements were possible. The motor portions of the fifth

nerves were likewise almost completely paralyzed. There was no strength in the masseters; the mouth hung open unless supported, and lateral movements of the lower jaw were impossible. The sensory loss in the distribution of this nerve was not conspicuous. The blood showed a slight achromia with a white count of from eight to nine thousand and hemoglobin of seventy per cent. The urine was of low specific gravity with at times a slight trace of albumin and many squamous cells, much detritus and a few leucocytes in the sediment. Suddenly, while in the hospital, she fainted, and died the following afternoon without the development of further symptoms. There had been during life no suspicion of other disease than that relating to the nervous system.

Autopsy. The post-mortem examination showed a double ovarian carcinoma with metastases in the retroperitoneal glands filling the pelvis. Both kidneys were riddled with cancer. There was thrombosis of the pelvic glands; complete occlusion of the right pulmonary artery; a riding thrombus in the foramen ovale and coronary embolus. Macroscopic examination of the brain stem showed nothing abnormal, but microscopically a process superficially resembling a neuritis was apparent in the course of the fifth, and, to a less extent, of the seventh nerves within the substance of the pons. This apparent inflammatory process was also evident on the surface, constituting a meningitis. The blood vessels in these regions showed an inflammatory reaction in their neighborhood, largely composed of lymphoid cells. The possibility of syphilis must be considered, although an absolute demonstration of this as a cause of the lesions cannot be determined in view of the fact that the spirochete were not demonstrated. The resemblance of the process to poliomyelitis, as recently observed, is certainly worthy of mention. Finally, an actual neuritis of the cranial nerves is not to be excluded as a possibility.

Diagnosis. The case is of interest because of the fact of the very unusual type of cranial nerve involvement and also because the apparently independent carcinoma had entirely escaped observation during life and had given rise to no symp-

toms whatever calling the attention either of the patient or of the physicians to the serious condition. Death evidently resulted from vascular disturbances centering in the heart. The lesion of the bulbar nerves is difficult to classify. Its inflammatory character lends some justification to the diagnosis of a true neuritis rather than to a primary degeneration of the bulbar nuclei, as supposed during life. The recovery of certain nerves after being definitely affected is also of importance in arriving at a conclusion as to the nature of the lesion. It is not probable that the pelvic carcinoma had any bearing upon the cranial nerve disease.

Prognosis. If the process had extended further, the patient would probably have died through lesions of the lower cranial nerves. As it happened, death resulted from a wholly unexpected cause, as described in the foregoing statement.

Treatment. Treatment was entirely unavailing and consisted merely in palliative measures. Had the cancer been recognized, the metastases were too wide to permit of operation.

Case 88. C., a woman of twenty-seven, married three years, had had one child under normal conditions except for a slight albuminuria. She was six and a half months pregnant with a second child. Up to within three years she had never had a headache and was, in general, well and actively employed as a teacher. About three years before being seen, she began to have headache, irrespective of pregnancy. The pain was occasionally throbbing in character, but for the most part dull. She had had no vomiting and considered herself well in other ways. During the past year she had worn glasses with benefit. She was seen April 9, 1910. For ten days the headache had been worse, throbbing in character, and later there was much shooting pain. She was not an imaginative or nervous person and her pain was evidently due to some well-defined though obscure cause. Exercise apparently had made the head pain worse, nor in the past had complete rest had a beneficial effect. She was most comfortable when engaged in her routine work. There was no nephritis or other disturbance of the kidney function. An obstetrician assured her that her discomfort had nothing to do with the pregnancy. A provisional diagnosis of influenza or typhoid fever had been made to explain her more acute illness of the preceding few days. Her temperature was from 100° to 102°; the fundus up to within a week had been clear; when seen she was suffering from photophobia, and for a day or two had had excessive vomiting.

Examination showed normal pupils in size, light reaction and accommodation. The fields were not restricted and the optic disks had a clear outline with no swelling. Her hearing was unimpaired and there were no other cranial nerve involvements. The arms were normal as regards sensation and motion; the liver was not enlarged; the heart gave no murmurs; the pulse was 100, regular; and the blood pressure was 125. The legs likewise showed no abnormality. The knee jerks were normal, there was no Babinski, no clonus, and a normal plantar reflex. The sense of position and other forms of sensibility were unimpaired. During the examination the patient vomited material mixed with bile, but without extreme nausea. A blood examination showed 24,000 white cells.

When seen again a week later a paralysis of a part of the left third nerve had developed, with immobile pupil. The vomiting had decreased and the headache certainly was not more severe than it had been. The temperature had remained elevated but not reaching above 102°. The pulse had been continually rising and the respiration becoming more rapid. For several days she had been mentally confused.

Examination at this time showed considerable mental disturbance. She talked vaguely and incoherently and gave evidence of occasional hallucinations of sight. She apparently was not in great pain. The left pupil was larger than the right and gave no reaction to light. There was slight reaction on the right. The fundus was absolutely clear on both sides and the disks were pale. There was paresis of the third nerve on the left, sparing the internal rectus. There was also slight paresis of the right external rectus (sixth nerve) and of the right facial nerve. The other cranial nerves were uninvaded.

The heart was excited, the pulse from 132 to 136, the pressure 120. There was no neck rigidity; neither knee jerks nor arm jerks could be obtained; there was no Babinski and very slight plantar reflex. The temperature was 102° or more. She seemed extremely ill, and no hope was held out for her recovery. No lumbar puncture was made. She died April 18 after an acute illness of about three weeks but with evidence of an underlying disturbance extending back for three years.

The **autopsy** revealed Tuberculous Meningitis of an unusual type as the cause of death. Lesions outside the nervous system were not significant. In addition to the meningitis, there was a considerable degree of encephalitis with generalized edema of the brain leading to pressure which no doubt in part explained the involvement of the ocular nerves. The pressure was, however, not sufficiently long continued or severe to produce choking of the optic disks.

Diagnosis. The diagnosis was not definitely made during life although a tuberculous process seemed the most probable explanation of the somewhat unusual symptoms. The fact that the disease occurred in an adult previously entirely

well rendered a definite decision still more difficult. Had a lumbar puncture been made, it is probable the character of the fluid would have determined the diagnosis. It would, however, have availed nothing by way of treatment. The existence of a continual temperature otherwise unexplained should always lead to the suspicion of tuberculosis and may with a fair degree of certainty exclude cerebral tumor as a cause of symptoms. (See Case 78.) A further difficulty lay in the fact that there was no clinical evidence of tuberculosis elsewhere in the body, although it was shown to exist in insignificant degree by the autopsy.

Prognosis. The outcome of tuberculous meningitis is from a practical standpoint to be regarded as always fatal, although certain evidence is accumulating to show that in rare instances recovery may take place.

Treatment. Treatment was naturally wholly unavailing in checking the progress of the disease. The extreme restlessness during the last few days of her life were in a measure controlled by the coal-tar drugs and by opium preparations.

Case 89. A., a man of twenty-seven, was infected with syphilis, and a chancre appeared about the middle of January, 1903. The sore was at first treated locally, but he was later given mercury internally and was apparently well until about six weeks before being seen, on June 15 of the same year. He then began to have headaches, chiefly at night, but was able to keep on with his work. At the end of two weeks he had a period of excessive vomiting, with pain over his right eye and temple, and suffered greatly at night. He had had diplopia with blurring of vision for about a month.

Examination showed widely dilated pupils with a rather slow light and accommodative response. Vision was poor and there was a marked double choked disk. There was internal strabismus due to involvement of both sixth nerves; one seventh nerve was also slightly paretic. The tongue was protruded to one side. There was no paralysis of arms or legs. The knee jerks were normal; the front tap present in both; no Babinski response. There was also no discoverable alteration in sensibility. The heart was normal; the pulse, 92.

Treatment was at once begun, with immediate improvement in all the symptoms. He was vigorously treated for a period of nearly two years, when he passed from observation. At the end of that time he was practically well. The headache disappeared; the diplopia no longer annoyed him; vision greatly improved and the choked disk entirely disappeared, leaving only slight evidence of connective tissue change along the vessels. He was able to return to his work, which required good vision.

Diagnosis. The clear history of infection and the subsequent symptoms point unquestionably to Cerebral Syphilis as the diagnosis in this case quite apart from the striking effect of treatment. The headache, chiefly nocturnal, gastric disturbance, choked disk, palsy of ocular nerves and general prostration are characteristic of a common type of syphilis of the central nervous system, due essentially to lesions at the base of the brain. The choked disk in these cases is not altogether easy to explain on the basis of general intracranial pressure now generally regarded as its cause; it is more probable in these cases that the pressure is locally exerted.

Prognosis. If taken early and treated actively cerebral syphilis of this type is remediable. As already stated, this patient recovered in an entirely satisfactory way; if, however, the process had been allowed to reach the destructive stage, very much less could have been accomplished. The important element in prognosis is, therefore, immediate and adequate treatment.

Treatment. Mercury by inunction (Ung. Hydrarg.) was given at once. It should be applied once daily in dram doses until an ounce of the ointment is used, unless the patient is mercurialized by that amount. In that event it may be rubbed in every other day. Mercury in this or some other form should be given, with intermissions, over a period of several months, and thereafter twice a year for an indefinite period. Iodide of potash was given in this case up to 90 grains t. i. d., either in the intervals of, or alternating with, the mercury treatment. It is rarely necessary to give more than this amount of iodide, and less is usually sufficient, especially if combined with mercury. It is well also to continue the iodide, at intervals, after the visible symptoms have disappeared. It is as yet too early to state the effect of " salvarsan " in cases of this sort, but sufficient experience has accumulated to justify its use. It had not been discovered when this case was seen.

Case 90. S., a young man of nineteen, while playing baseball, was struck by a pitched ball in the left occipital region of the head. He dropped at once to the ground but was not unconscious. He got up in a dazed fashion and wished to go on playing. He was able to walk to a carriage, but when put to bed was still in a confused state. He talked very little, vomited during the night, was restless and in pain. In the morning he fell asleep and was drowsy the following day. He did not seem to grow worse. He still talked very little and misused words, choosing wrong words to express his ideas. He was, however, conscious of his mistakes. When seen by a physician, his pulse was 48, regular, not of apparent high tension; later it became somewhat arythmic. The following day he was taken to a hospital.

When examined there the following conditions were found. The pupils were equal and reacted normally. The day before he had had some diplopia, but there was no visible paralysis of the ocular muscles. The temperature was 99°. He was evidently in a good deal of pain, referred particularly to the point where he had been struck. There was, however, no sign of fracture and no discharge from the ear. He was conscious; his mind was perfectly clear and he was disturbed somewhat by the examination. In speaking he still mixed his words, but for the most part easily made himself understood. He was inclined to yawn continually and to fall off into a doze. Further examination showed a certain apathy and slowness but otherwise no mental disturbance. The fundus was possibly slightly hazy but there was no swelling or hemorrhage in either eye. Hearing was normal; there was no facial paralysis and no limitation in the movements of the eyes; the heart showed no murmurs; the pulse was 52; the pressure, 135. The arms showed nothing abnormal as regards strength, sensation or reflexes. There were slight abdominal reflexes. The knee jerks were normal; there was no clonus; the Achilles reaction was not obtained; the plantar reflex was normal. Sensation of the feet, including sense of position, was unimpaired. There was, and had been, no sphincter disturbance. In general, therefore, the physical examination was essentially negative except for some slowness in mental

processes, a slow pulse and a slight speech defect. Improvement began at once and continued uneventfully.

He was not seen again until about four months later. He then stated that some slight difficulty in speech persisted for nearly two months after the accident, with continued difficulty in finding the right words. He had also had vertigo, especially on quickly turning his head or suddenly rising to an erect position. There had likewise been more or less pain at the back of the head when using his brain or eyes. Sleep had not been quite so good as formerly, and he had grown somewhat nervous about himself and about his possible future. He had difficulty in applying himself to his work and had found it difficult to play active games, such as tennis. Physical examination at this time revealed nothing abnormal. The pulse was 72 and the blood pressure 135, exactly as two or three days after the blow.

Diagnosis. This patient suffered a relatively mild Concussion or slight Contusion of the brain, leading to a certain degree of cerebral edema, not, however, reaching a point at which life was in any way threatened. The symptoms in cases of this sort are doubtless due to the edema of the brain consequent upon the blow rather than to the direct effect of the injury itself.

Prognosis. The prognosis in this case was given as entirely favorable, which the event justified in great measure. A certain defect, however, persisted for a long period, characterized by rather general nervous disturbances, which had proved a distinct handicap. Under proper conditions, recovery should ultimately be complete. In general, a guarded prognosis should be given immediately after an accident to the head, on the ground that the final effect depends largely upon the degree of edema induced and this can never be definitely determined until several days at least have elapsed. If the tendency from the first is toward improvement and at the end of the third or fourth day there has been no increase of mental apathy, a favorable prognosis may be given. It should be remembered that it takes often several days for the edema to reach its height and that the interval immediately after the accident may show relatively normal condi-

tions. An increase of stupor is, therefore, always a sign of danger.

Treatment. Absolute quiet, a low diet, a darkened room and careful nursing are the requisites of treatment in the early stages. Operation in the absence of fracture is rarely justified except in those cases where the pressure is evidently increasing to an alarming degree. Lumbar puncture is a method of doubtful utility, since the brain substance itself is edematous. Should operation be undertaken, a generous opening in the skull should be made. In this case, no active treatment was necessary.

Case 91. E., a boy of ten, on November 7, 1909, was struck by an automobile. The main injury was in the left parietal region of the skull, back of the ear. There were no immediate convulsions or vomiting and he was not deeply unconscious, even immediately after the receipt of the blow. He was seen at once by a physician, who removed splintered bone, finding the dura lacerated and the brain substance oozing from the wound. There was no extensive hemorrhage, but several vessels were tied in the course of the operation. At first the temperature was 100°, the pulse 62 and the respirations 20. On the third day, the temperature rose to 102.8°. He was seen and examined the fourth day after the accident. He had at that time not recovered consciousness, but he was able to swallow and ate with apparent relish. He had not spoken and there was no conspicuous paralysis.

The patient was lying on his right side and there was a large ecchymosis about the left eye. A surgical wound two to three inches in length somewhat loosely stitched appeared in the left parietal region. Between the stitches of this incision, normal, apparently uninfected brain substance was oozing. Since the day before there had been at first intermittent and later more constant spasmodic movements of the right side of the face and the right arm, especially of the hand. During the examination, there was constant twitching of the right facial muscles, particularly noticeable about the mouth. There was also constant spasm of the right arm. The eyes were turned strongly toward the right (conjugate deviation) with extreme nystagmus. Later, during the same examination, there was a temporary cessation of the spasmodic movements; the eyes turned in the other direction and the nystagmus also ceased. The pupils gave a fair light reaction. Except as stated the right arm was not moved. Knee jerks were both very active, the right slightly more so than the left; there was a definite Babinski response on the right, doubtful on the left; Achilles reaction was present on the right, not obtained on the other side. There was evident paresis of the right leg, but on pricking it was drawn away. The body showed a number of bruises. The patient was stuporous but could be roused though not to the point of speaking.

In spite of the very serious injury to the brain and to the loss of a part of its substance, the boy made an uninterrupted recovery. A report, February 23, 1910, was to the effect that he had gained in weight and that he felt as well and strong as ever. His father thought that his speech was slightly affected still. In general, however, the boy was well and without motor defect.

Diagnosis. In this case there was fracture of the parietal bone on the left side, with laceration of the dura and brain. The spasmodic movements are to be explained either by *contre coup* injuring the motor region or more probably by the general Concussion and Contusion which the entire brain received, with consequent Edema. The spasmodic character of the motor disturbance pointed to an irritative rather than a destructive lesion, as did also the deviation of the eyes. The fact that he recovered without motor loss bore out this assumption. The trifling persistent speech defect is probably to be explained by a slight invasion of the speech area by the traumatism. The area invaded was, however, not concerned primarily with important objective functions. Hence, a violent injury there would be far less productive of conspicuous results than in certain other portions of the brain.

Prognosis. The case demonstrates that if sepsis can be avoided, extremely severe injuries to the brain may not prove fatal. This is particularly true in young children. The loss even of considerable amounts of brain susbtance is not permanently deleterious, provided a silent area of the brain is invaded, as in this instance.

Treatment. The treatment consisted in careful surgical asepsis and the administration of urotropin in doses of fifteen to twenty-five grains a day, as a prophylactic measure.

SECTION IV.

CONDITIONS OF VAGUE OR UNDETERMINED PATHOLOGICAL BASIS.

The following cases, classified as "Conditions of Vague or Undetermined Pathological Basis," constitute a large group in which investigation is rapidly progressing toward more accurate knowledge. It appears probable that many of these conditions will soon definitely be placed in the category of diseases with a fixed underlying pathological anatomy. In the meantime, they may be considered as on the border line between the so-called organic or structural diseases and those which are clearly of psychogenic origin. The cases in this section are, therefore, to be regarded as in that large provisional class sometimes spoken of as the neuroses, since their exact anatomical basis is as yet uncertain. It is important that they be distinguished, on the one hand, from those conditions of which illustrations are given in the foregoing sections, wherein there is no further doubt of the anatomical basis, and, on the other hand, from those in which it is equally evident that the mental factor is predominant both in etiology and pathology.

Case 92. H., a man of fifty-four, had noticed tremor of the left hand for three or four years without the slightest extension to the right hand or to other parts of the body. With this had come on difficulty in free movement. He had no pain excepting in the region of the heart, and no headache; his appetite was good, his bowels constipated, and he was obliged to get up once or twice at night to pass urine. His sleep was imperfect, but he had no other special concern than the tremor and the general slowness of movement. He had also noticed, as a special annoyance, a tendency to laugh without cause.

During the examination, he continually laughed uproariously and occasionally wept, entirely without cause. The

most trifling matter, he stated, would bring about this emotional outbreak, laughter being much more easily aroused than weeping. When asked a perfectly simple question, he answered, " Yes, sir," followed by a period of uncontrolled laughter. The pupils were normal, the right slightly smaller than the left; hearing was adequate; there was no palsy of the tongue or of deglutition, and in general the cranial nerves were free from involvement except for an unassociated blepharospasm. The face was without tremor. The arm reflexes were normal and there was no sensory loss. When at rest, the left hand was in a continuous state of tremor, easily checked by movement. The legs showed no abnormality. The heart was without murmurs, the pressure 220, the pulse 100, of fair regularity. A urinary examination showed the specific gravity to be 1,015 with no albumin. As he walked the body was bent forward with an apparent constant tendency to fall; movements were awkwardly performed and evidently with an effort. His face was expressionless and the speech very slow and monotonous but not otherwise defective.

Diagnosis. This is an unmistakable case of Paralysis Agitans (Parkinson's disease) as shown by the combination of general muscular rigidity, monotonous speech and tremor, together with a characteristic propulsive manner of walking and an expressionless face with perfectly retained intelligence. The diagnosis may often be made in the absence of tremor; in this instance involuntary movements were limited to the left hand, although the disease was well advanced. The characteristic of this tremor as contrasted with that of multiple sclerosis is that it persists during rest and ceases temporarily on active movement toward an intended end. The tremor, or more properly ataxia, of multiple sclerosis is brought out only on intended movement. (See Cases 49, 50.) In spite, however, of the very marked dissimilarity of the two forms of tremor, in certain stages confusion may arise. The most important diagnostic feature of paralysis agitans is the muscular rigidity, upon which, in fact, the other signs and symptoms, including the speech defect, depend. The disease may be mistaken for myxedema when the tremor is lacking,

but on careful examination this mistake should not occur, particularly after a trial of thyroid medication. The forced laughter in the foregoing case is a chance accompaniment of paralysis agitans, often very strikingly developed in certain lesions of the bulb. The high blood pressure indicates the probability of a coincident nephritis.

Prognosis. The affection is very slowly progressive and ultimately fatal, usually through lowered resistance and the final invasion of intercurrent disease. The duration is from five to twenty years.

Treatment. It is unwise to attempt too much in the treatment of paralysis agitans. Fluid extract of hyoscyamus was given in this case in doses of from 5 to 10 drops three times a day. The result was not appreciable. A bromide preparation, 10 grains of the sodium salt, was also given, together with cascara sagrada. More important is regulation of work, avoidance of undue excitement and general hygiene. In spite of all that may be done, the disease is hopelessly progressive.

Case 93. I., a boy of twelve, had an attack of scarlet fever in February, 1907, from which he recovered satisfactorily without an accompanying nephritis. He had previously had measles, whooping cough and tonsillitis. In general he had always been well and strong. There was no history whatever of rheumatism. Four weeks before being seen, on May 31, 1907, twitching of the right hand developed, but on inquiry it transpired that there had also been movements of the nose and upper lip, with raising of the shoulder. There were also involuntary movements of the right leg which the patient thought had begun after spraining his ankle. His appetite and sleep were satisfactory and his bowels regular in action. He had been accustomed to eat bread, butter, eggs and milk. He was, however, addicted to candy and drank tea to some extent.

Examination showed that the involuntary movements were confined to the right side. He walked badly, striking his left foot on the floor in an incoördinate fashion. These movements were not simple repetitions, but were irregular in character. The pupils gave a good light reaction. The heart sounds were normal, the pulse 100, and of good rhythm. The knee jerks were slight.

Diagnosis. When this patient was seen, he was undoubtedly suffering from Chorea, limited to one side. It is, however, doubtful whether the earlier movements of the face and shoulder belong in the same category. From a diagnostic standpoint, the case is of interest because two distinct though possibly allied disturbances were combined in the same patient which are often confused. Involuntary or semi-voluntary movements repeated continually in the same way and confined to certain well-defined groups of muscles are more properly regarded as a form of Tic or Habit Spasm than as choreic. This was the type of disturbance which the patient evidently primarily had; the later and presumably independent condition was characterized by entirely incoordinate movements, irregularly performed and not confined to any one set of muscles. Such irregular movements constitute the motor disturbance of chorea. Although more commonly bilateral, the disturbance may, as in this case, con-

fine itself to one side. Rheumatism is frequent in the etiology of minor chorea, but by no means constant.

Prognosis. The prognosis of the chorea in this case is entirely favorable. It is in general a self-limited disease. The associated habit spasm is not self-limited, but may be remediable through painstaking training and re-education.

Treatment. Fowler's solution in doses of from 5 to 15 drops should be given after each meal, care being taken to stop or diminish the dose as soon as toxic effects manifest themselves. A good method of administering the drug is in the form of tablets of arsenite of potash, one one-hundredth of a grain being equal to approximately a minim of the Fowler's solution. It is important, also, that rest and avoidance of excitement should be insisted upon, together with a limitation of the diet to absolutely simple and nutritious food, and scrupulous regulation of the bowels.

Case 94. S., a boy of eight, for a year had developed nodding movements of the head. For several weeks past, twitching of the legs had come on, together with a curious habit of squatting with a certain twisting of the legs. These movements were repeated in almost the same way again and again. There was a doubtful history of rheumatism, but in general the boy had been well and was not overmuch addicted to candy. He drank neither tea nor coffee. He had been carefully brought up by his parents in the country and naturally had spent much of his time out of doors. There was one older child in the family, who was well.

The eyes, carefully examined, showed no abnormality. The knee jerks were slight but normal; the bowels moved regularly and in general the physical condition of the patient beyond his involuntary movements was normal. The heart showed no evidence of endocarditis.

When seen again some years later the habits had been almost entirely overcome, although there were still some slight movements, as, for example, rolling of the eyes.

Diagnosis. This patient was suffering from what may properly be called Habit Tic. The mistake is frequently made of confusing this common condition with chorea. The essential difference lies in the fact that chorea is constituted by incoördinate movements in various groups of muscles, whereas a tic of this type is characterized by the repetition of the same movements in certain groups of muscles and may, therefore, be brought into the category of habit. The term "habit chorea" has at times, but inaccurately, been applied to this condition, the etiology of which, admitting an often undiscovered cause, develops on the basis of repetition.

Prognosis. In this case the outcome was satisfactory, and it is not to be doubted that the boy will in time entirely overcome his various habits. In general, if treatment be undertaken early, the prognosis is favorable. Such a habit spasm may, however, under certain circumstances, persist through life.

Treatment. The treatment is educational. If the child is old enough, it is essential to expain to him the nature of the trouble and the part which habit plays in its production.

His coöperation may thereby be gained and remarkable results often follow certain exercises and training in control in the effort to overcome the abnormal movements. As a principle, it is desirable to substitute voluntary for involuntary movements in the hope that ultimately the power of complete control may be regained. Drugs are unnecessary, except as they may be required to meet special indications.

Case 95. T., a man of thirty, a clerk by occupation, was seen in September, 1908. The February before he had had an unusual sensation at the back of his head. He recognized the fact that he had been overdoing for several years, his work demanding his Sundays and evenings. He had had no vacation for four years and he felt that he had been somewhat over-conscientious. He went to bed tired and woke equally so, although he appeared to sleep well. He had no headaches; his digestion and appetite were good. There was also no special source of worry except that which arose in connection with his employment. He was extremely nearsighted and the glasses prescribed were presumably not correct. Much of his work consisted in writing, in doing which he held his head more or less to one side. The sensation first noticed in his neck gradually developed into a feeling of drawing toward the left side. This grew worse until he was conscious of abnormal sensations above the shoulder in the region of the trapezius muscle and also in the shoulder blade. The arm and ulnar side of the left hand were also somewhat affected. The neck grew steadily worse, with a strongly developed tendency to turn invariably toward the left with the chin tilted slightly upward. The shoulder, he thought, was somewhat raised in this process. The difficulty had developed to such a degree that movement of the head was practically constant while he was on his feet, and especially when he was in motion, either walking or riding. It was not noticeably worse while he was at his work.

The pupils were equal, with normal light reaction, and the eyes showed a high degree of myopia. There was no palsy of any cranial nerve; the heart was negative; the knee jerks normal. The spasm was confined largely to the right sternomastoid muscle. It was possible to overcome this spasm by a very slight pressure. There was no definite objective disturbance of sensation either in the left hand or in any other part of the body. The heart was normal; the pulse 88 and regular. The physical examination was, in general, entirely negative except for the muscular spasm described.

Diagnosis. This is a typical example of Spasmodic Torticollis, involving essentially the right sternomastoid muscle,

the function of which is to turn the head in the opposite direction, very slightly tilting the chin upward. The etiology is obscure, although in this case it is possible that the character of the patient's work, writing constantly in one position, may have been an exciting cause.

Fig. 37. Spasmodic Torticollis, Involving Chiefly the Right Sternomastoid Muscle.

Prognosis. It has not been possible to follow this case. In general, torticollis of this type is a stubborn affection, occasionally curable by simple means and often incurable even by radical surgical procedures.

Treatment. In this case coördinative exercises with possible subsequent operation were advised. The attempt should always be made to re-educate the muscle or muscle group temporarily beyond the control of the will by carefully executed active and passive movements faithfully carried out. In this attempt the definite relation between the mental state of the patient and the spasm should constantly be borne in mind. Surgical interference is justified when other means fail, but when undertaken the operation should be radical.

Case 96. O., a married woman of forty, of neurotic type, had been extremely nervous for a number of years. A diagnosis of Graves' disease had been made two years before. She had been treated by aconite and applications of ice without marked effect. For a year and a half she had been particularly debilitated, the pulse rate being from 115 to 120, associated with extreme general nervousness. The eyes had been prominent at one time; she had not had much sweating; the thyroid gland was considerably but not excessively enlarged. The measurement of the neck was thirteen and a half inches.

Examination showed the patient to be in a very excited, overwrought condition; the pulse when first taken reaching to 160 and later falling to 128, and somewhat irregular in rhythm; the heart gave no murmurs, but on the left side of the neck there was a loud systolic thrill suggestive of an aneurism. This was much less marked on the right side. The lateral swelling of the thyroid gland was not extreme and there was no exophthalmos. There was considerable general tremor, with a highly nervous manner.

Hydrobromate of quinine did not give relief. She continued to grow more disturbed and appeared on the verge of a psychosis. She was in a state of great anxiety regarding herself, which was increased by the undue solicitude of her husband. It was finally decided to attempt an operation. A part of the gland was removed surgically, but the patient never recovered completely from the anesthetic and died in six hours.

Diagnosis. The patient was suffering from Exophthalmic Goitre in which the general poisoning of the system was extreme but without the frequent definite physical signs of exophthalmos and great swelling of the thyroid gland. The characteristic nervous symptoms were particularly well marked and the general resistance of the patient was evidently somewhat reduced.

Prognosis. Had an operation not been undertaken it is probable that the patient would have continued a sufferer from her disease without marked amelioration.

Treatment. Treatment by means of rest, bromide of quinine and other measures had been faithfully carried out in this

case without result. The situation justified operation, but, as not infrequently happens, the resistance of the patient was such, or the intoxication resulting from the partial excision of the gland was so extreme, that death almost immediately resulted. Operation in cases of exophthalmic goitre should always be undertaken with caution and with explanation to the family that the outcome is more likely to be fatal than in other operations of apparently similar menace.

Case 97. R., a married woman of forty-four, had been ailing for four years. She was supposed to have had anemia in some form, but the history was indefinite on this point. She "seemed dropsical," was bloated, and was thought at one time to have had "kidney disease." This was, however, proved not to be the case. After a journey she apparently recovered from her disabilities. She also suffered from profuse menstruation. Two years before being seen she was again in a debilitated condition and began to become deaf. She had a cough and choking sensations and her speech and voice changed. She spoke in a somewhat scanning manner and when tired had special difficulty in enunciation. Her feet and hands were cold and she had occasional pain in the back. She found great difficulty in doing her work and was finally obliged to give it up entirely. Her movements became slow and she again became, as she expressed it, "bloated."

On examination, her face was unnaturally full and puffy in appearance. The skin was dry; her hair was falling and brittle. Sweating was diminished except in the axillæ. The pupils and fundi were normal and the cranial nerves free of involvement excepting the auditory. Air and bone conduction were defective in both ears and she was distinctly deaf. The sounds were faint, but the heart was otherwise normal; the pulse was 64, the blood pressure 135. The reflexes were present and in no way remarkable; there were no muscular tremors. The patient was lethargic in manner and slow of speech. The thyroid gland was not palpable.

Diagnosis. A diagnosis of Myxedema was made in this case from the dry skin, the sparse and brittle hair, the general tendency toward swelling, especially about the face, together with a slow pulse, lethargic manner and the lack of a palpable thyroid. The general appearance of a person suffering from myxedema is usually unmistakable, though difficulty may occasionally arise in differentiating it from paralysis agitans without tremor. The therapeutic test is then decisive.

Prognosis. Although the metabolic changes caused by the lack of thyroid secretion are undoubtedly profound, the prognosis is good on account of the efficiency of treatment.

Treatment. The deficiency of the thyroid gland is ade-

quately met by the long-continued administration of desiccated sheeps' thyroid, beginning with 1 to 2 grains t.i.d. and increasing gradually to the point of toleration. An average amount for an adult is from 3 to 5 grains thrice daily. The treatment must be continued indefinitely, if the disease is to be held in check.

Case 98. I., a boy of fifteen, had been well up to twelve and a half. Then suddenly, while bathing, he fell to the floor, had a general convulsion, with frothy saliva at the mouth, but did not bite his tongue nor have any involuntary escape of urine. There was general twitching of the muscles for a few minutes (probably not more than three, although the parents thought ten). He was unconscious for nearly two hours. Following this early attack he had had many others at very irregular intervals. At one time he went for six months without a seizure. At other times during the past two and a half years he had had attacks at intervals of from two to four weeks and for a certain period even as often as every other day. He injured himself only once, explainable, no doubt, by the fact that he had a preliminary aura in the form of dizziness and a sensation as if he did not know whether his foot was on the ground or in the air. He also had in conjunction with the more serious attacks, with prolonged loss of consciousness, brief attacks of temporary confusion (*petit mal*). In general, he was well, the bowel function was regular, his sleep was satisfactory and his appetite fairly good. He ate salt moderately but was in the habit of taking considerable meat. He drank tea and coffee, but not in excess, and did not smoke. He had not done well at school and was the least bright of the nine children in his family. He ate much candy and asserted that he always had an attack soon after eating Bologna sausages.

Examination showed no signs of focal disease of the brain. The pupils, knee jerks, heart and pulse were normal, the latter 120, owing in part, no doubt, to the examination. There was no drug eruption, but the boy appeared rather dull mentally.

Diagnosis. Epilepsy is the only condition to be considered in this case, apparently of the so-called idiopathic type. General convulsions of sudden onset, clonic and tonic in character, of brief duration, followed by a varying period of stupor, often with injury through falling or through convulsive closure of the jaws, are characteristic of the epileptic seizure.

Prognosis. The outcome in this case is likely to be unfavorable. The boy is of somewhat deficient mental develop-

ment, the attacks have appeared early in life, have occurred often and are with difficulty controlled by treatment. Under these conditions, the likelihood of complete cessation of the attacks is very much reduced. Under proper conditions of relative isolation, the patient should lead a reasonably useful life.

Treatment. A mixture of sodium, potassium and ammonium bromide with benzoate of soda in the proportion of an ounce of sodium bromide with half an ounce each of potassium and ammonium bromide and benzoate of soda, to eight ounces of water, is a good prescription. This gives 15 grains of the bromides to each teaspoonful. It should be given beginning with dram doses at night and increasing to two, three or even more teaspoonfuls in the course of the day, preferably after meals. Meat of the finer qualities may be allowed once a day. Common salt should be restricted. The diet should be nutritious, not too much of it, with an avoidance of the richer and more highly spiced foods. The essential element in diet is moderation. Under strict hygienic conditions with judicious administration of bromides this patient and persons in general suffering from epilepsy are ordinarily greatly benefited but not cured.

Case 99. E., a woman of fifty-five, had had attacks of loss of consciousness for upwards of a year, dating, as she thought, from her father's death. Previous to that time she had been well and hard-working. The course of an ordinary attack was as follows: A sudden fall without warning, except at times for a preliminary period of yawning, followed by loss of consciousness and rigidity, and recovery without resulting paralysis of any sort. On one occasion there was involuntary escape of urine. She also had had attacks of similar sort at night, as shown by disarranged bed clothing and hair. After the attacks she felt exhausted for a varying time. On one occasion when she got up in the night she fell in a seizure and injured herself about the knees and ankles. The attacks described above had become increasingly frequent and were seriously interfering with her work. Her general condition had, however, remained good; her sleep and appetite were unimpaired. She had passed the menopause about four years before without noteworthy disturbance. She had of late secreted a large amount of urine, especially at night, presumably due to her general nervous state, inasmuch as an examination showed no abnormality. The bowels were not constipated. She had at no time had colic suggestive of lead poisoning; there was no paralysis and no lead line on the gums.

Examination showed normal pupils, with good light and accommodative response and unrestricted fields. The borders of the disks were not well defined on the inner sides but there was no swelling. Hearing was normal and the cranial nerves were in general uninvolved. The knee jerks were normal. The heart was unimpaired, the pulse 128, the pressure 140.

Under treatment there was improvement, but at the end of a week she again had two attacks in one day; these were, however, slight in character, with very brief loss of consciousness and without convulsion. A few days later she fell and injured her chin and probably had a convulsion. She had a persistent sense of weakness and lassitude and grew depressed and emotional.

Diagnosis. This condition is undoubtedly Epilepsy coming on late in life and without discoverable cause. In general, epileptic seizures should be regarded as presumably symp-

tomatic of some underlying condition; especially is this true if they develop after the third decade. It not infrequently happens, however, that no underlying cause can be found either in the condition of the arterial system or of the brain, as in this case. Brain tumor should always be suspected, and a possible antecedent syphilis should be investigated.

Prognosis. The outlook for cure in the sense of entire cessation of the attacks is not to be expected in this case. She has improved under treatment but at the last report continues to have attacks.

Treatment. The same measures in treatment are useful as in cases coming on early in life. (See Case 98.)

Case 100. S., a woman of thirty-nine, married, the mother of one child, for upwards of twenty years had had occasional "sick headaches." Her mother and brother had similar headaches. Eighteen years before being seen, she had had twinges of pain through the face and head, varying widely in position from time to time, and also in character. This pain was greatly relieved after vomiting. She had also noticed during her attacks of pain the appearance of dark falling objects in the visual fields. In general, the pain was on one or the other side, not on both at the same time. Her upper teeth were false; she had had no nasal trouble or sinus inflammation. She did not wear glasses. Her digestion was imperfect. Her sleep was poor and she was in general unnerved by the exigencies of her life, although it was not a hard one. It appeared on further questioning that her head pain was nearly always associated with nausea, and that following the pain she was apt to vomit. In the severe attacks she had a general exhausted feeling, and her arms and legs felt numb and prickly. There was also a sense of temporary throat paralysis. The average number of attacks was one in two weeks; she was especially likely to have one at her menstrual period.

Examination showed normal pupils and fundi with unconstricted fields. There was a tendency to external squint leading to imperfect convergence; otherwise the cranial nerves were normal. The heart was negative, pulse, 80, pressure 140. The arm and knee jerks were normal.

In consideration of the eye condition, she was referred to an ophthalmologist, who reported slight hypermetropia with insufficiency of convergence to the amount of 10°, and also some vertical deviation. It was, however, his opinion that this amount of defect presumably had no bearing upon her head disturbance.

Diagnosis. This case is undoubtedly one of Ophthalmic Migraine, which has changed its form during the course of the patient's life. In her early years she had had what she recognized as an ordinary sick headache; this later took on the form of neuralgia, but at no time was limited to any definite nerve distribution. The visual symptoms, e .g., sensation

of falling objects, together with the frequently unilateral headaches associated with vomiting, the disturbance occurring in distinct attacks, all point toward the diagnosis of migraine. The sensory phenomena, to which allusion was made in the history, are also characteristic. The long persistence of the disturbance and its paroxysmal character rendered it unlikely that eyestrain was an important factor in its production, as described, for example, in Case 101. Migraine may at times be mistaken for epilepsy of the Jacksonian type or for other grave cerebral disorders. The combination, however, of visual disturbances, scotomata, or transient hemianopsia followed by headache, especially if unilateral, and later by vomiting, form an unmistakable group of symptoms. The unusual manifestations of migraine are frequently somewhat difficult of diagnosis.

Prognosis. Migraine is an exceedingly stubborn disturbance to treat with success owing to its frequent constitutional character. The condition may improve, however, with advancing years and not infrequently disappears spontaneously, or after the removal of some apparently trifling source of irritation.

Treatment. All sources of peripheral irritation should be removed. Visual defects and refractive errors should be corrected. The gastro-intestinal tract demands attention in many cases. Drugs are essentially unavailing except as a means of relief of immediate pain. Acetanilid, phenacetin, the bromides, aspirin, may be used with discretion in dealing with the actual attack. A vigorous catharsis is also frequently useful in modifying an attack. The opium preparations should be avoided absolutely. During the attack, if severe, it is desirable to have the patient go to bed during the continuance of the pain. An encouragement of vomiting at times brings relief.

Case 101. N., a married woman of fifty-two, had always considered herself well, in spite of the fact that she had valvular disease of the heart, which, however, had occasioned her no inconvenience whatever excepting some shortness of breath on exertion. Examination of the urine showed no abnormality. For five weeks before being seen, she had had occipital and frontal headaches; the skin of the scalp was not sensitive; there was no actual pain on pressure; she complained of no other symptoms. She was not of nervous temperament and the menopause had been passed two years before.

Examination gave a good pupillary light reaction with less active accommodation. In talking with her, there was no observable strabismus. As she continued, however, to fix her eyes on a given point, it was noticed that they gradually diverged. Further investigation showed that convergence at close range was not possible without pain and discomfort, through evident weakness of the internal recti. She had worn glasses for three years, presumably prescribed by an optician. Her headache had become most distressing but had not been associated with vomiting. The knee jerks were normal and the examination otherwise disclosed nothing.

Diagnosis. In consideration of the manifest difficulty in convergence, it was assumed that eye strain was, in this case, the cause of her head discomfort. This proved to be the case. The localization of pain due to eye strain is usually frontal or occipital.

Prognosis. Proper correction of the eyes resulted in complete relief of the symptom of head pain.

Treatment. She was referred to an ophthalmologist, who found no difficulty in correcting the muscular error sufficiently to insure a cessation of the eye strain. No other treatment was required.

Case 102. E., a woman fifty-two years old, had noticed that, about nine years before, she had been obliged to have her ring enlarged. Four years before being seen, early in 1910, her hands had begun to feel awkward and she found difficulty in closing them completely. There was slight enlargement of the thyroid gland. Thyroid extract was administered with apparent benefit, so far as the condition of her neck was concerned. This, however, had at no time given her serious annoyance. Of more importance was a gradual enlargement of the hands. She had formerly worn a six and a half glove and now was obliged to use a seven to a seven and a quarter. She was unable to get a large enough thimble to fit her finger. Her feet had not increased in size in proportion to the hands. For the past month she had had considerable pain, especially in the joints, and her voice had become somewhat hoarse. In general, she felt well, walked with pleasure and led an active life. Her bowels were costive and her menstruation had ceased. Both mentally and physically she had retained her former activity. She had no headaches, but the previous summer she had had several attacks of vertigo without vomiting. This was apparently helped by glasses. She had had no difficulty with her eyes beyond such as were incident to her age.

Examination showed extremely coarse features, a broad nose and a somewhat oily skin. The hair was not remarkable. The hands were immediately noticeable for their very exceptional size. They were very large and clumsy, but not edematous or unsymmetrical in development. They gave the appearance which one might expect in a large man rather than in a somewhat small woman. Without having been told, it would have been sufficiently evident that both the features and the extremities had changed through an increase in size and coarseness. The pupils, fields, fundus, heart and knee jerks were normal; the pulse was 88 and the blood pressure 135.

Diagnosis. The condition in this case is unmistakably Acromegaly, an affection presumably dependent upon disorder of the pituitary gland. The affection is characterized, as its name implies, by a more or less symmetrical enlargement

of the extremities, particularly of the hands, and by general coarsening of the features, with other disturbances of metabolism.

Prognosis. The disease is not in itself fatal but is gradually progressive.

Treatment. As yet no treatment has been found efficacious except the possible operation on the pituitary gland itself, which has been done a number of times with success and improvement of symptoms. The operation is naturally one of extreme difficulty, owing to the deep-seated position of the gland.

Case 103. U., a woman of thirty-six, twelve years before being seen had given birth to a baby which had lived three months. She had had no children since and there was no history of miscarriages; in general, she had been well until within four months. She then noticed that " her tongue grew thick so that she couldn't talk." At times she could hardly be understood; her speech, she thought, had changed. There had also been difficulty in swallowing, but there had not been actual regurgitation, either of food or water. Of late, she had had difficulty in moving her tongue; this was more marked as the day wore on and she grew increasingly tired. She had had transient diplopia and at times much weakness of the hands. While feeding the mangle, for example (she was a laundress), she found that her hands would finally give out completely, but that she could go on again about as well as before after a short rest. Again, she was unable to dress or undress herself properly on account of tire and accompanying weakness. In highly coördinated muscular acts, like buttoning, the fingers would finally refuse entirely to work. Frequently, when talking, she would somewhat suddenly begin to stutter and her speech would then become so confused and thick that it often became unintelligible, recovering again after a rest. On one occasion she felt as if choking and had difficulty in breathing. This lasted for about a day and then improved. Walking also tired her easily. She was, in general, much more easily fatigued than formerly by any continued muscular movement.

Physical examination showed the following conditions bearing out entirely the patient's statements regarding muscular weakness. The pupils gave a good light and accommodative response, and there was no palsy of any of the ocular movements; the visual fields were normal. The lids, however, both shut and opened very imperfectly; it was apparently somewhat harder for her to close her eyes than to open them, and impossible to keep the lids closed against resistance; winking was weakly performed. The sensation of the face was unaffected, and at the time of examination there was no apparent weakness of the muscles of mastication. Chewing movements had, however, at times been difficult. Hearing was

intact. The face was imperfectly movable on both sides and, in consequence, was somewhat expressionless; fine muscular movements of the face were impossible. The tongue was protruded somewhat imperfectly, but its movements were possible and it was not atrophied. The pharyngeal reflex was present. In other respects the cranial nerves showed no involvement. Hand grasp was good on both sides and not easily exhausted. Wrist and elbow jerks were not obtained. Sensation of the arms was normal. The knee jerks were active and were not exhausted after a hundred or more blows. Further testing of muscular fatigue showed that the constrictors of the pupil tired after four or five flashes of a bright electric light. An attempt to repeat the alphabet rapidly a number of times finally led to confusion and practical unintelligibility, evidently through muscle tire. The electrical reactions varied in different groups of muscles. An interosseous muscle was easily exhausted, a forearm flexor uncertainly and a facial muscle not at all by electrical stimulation. An electrical examination on another occasion showed a decidedly greater tendency to exhaustion.

Diagnosis. This is undoubtedly a case of Myasthenia Gravis. The tendency to muscular fatigue on exertion, often amounting to temporary paralysis, with quick recovery on cessation of work, is characteristic of this disease of unknown etiology. A quick tiring of muscles on continued electrical stimulation, known as the "myasthenic reaction," is pathognomonic. The inconstancy of the paralysis is sufficient to differentiate it from conditions of nuclear ophthalmoplegia (see Case 83) or bulbar lesions of similar type, though in certain stages it may easily be mistaken for such lesions.

Prognosis. The outlook for recovery is poor and for life uncertain. There is always danger of sudden death when the lower cranial nerves are affected; on the other hand, remissions are frequent and often of considerable duration.

Treatment. No efficient treatment for the condition is known. Much may, however, be done by way of prophylaxis in warning against over-exertion and particularly in urging extreme care when the nerves of deglutition and respiration are involved.

Case 104. R, a married woman of fifty-seven, had suffered for five years from a burning sensation in both hands. She also had a similar sensation in the face. Cold seemed to be the cause. The condition was always worse in cold weather, although it continued to a certain extent during the summer. She had particularly noticed that putting her hands in cold water produced this burning sensation. For two or three years she had noticed numbness of the hands, unequal on the two sides, especially at night. The lifting of a watch, for example, was at one time hardly perceived. She also, at times, had considerable pain, associated with the numbness, but without muscular weakness. Her feet were never so affected. In other respects, she regarded herself as well. She had on occasions been conscious of heart palpitation but had not suffered from shortness of breath. She had had no definite headache but had had chronic constipation for years.

Examination gave normal light reactions and normal visual fields. There was no objective disorder of sensation in the face, palsy or other disturbance of any of the cranial nerves. The heart was normal; the pulse regular, soft, 88; the knee jerks were normal. Careful examination of the hands with reference to disordered sensation showed no abnormality either to heat, cold, pain, contact or in the stereognostic sense. The wrist jerks were normal and the strength unimpaired.

Diagnosis. Acroparesthesia, an affection without objectively discoverable basis, characterized by numbness and parathesia of the extremities, chiefly the hands, often seen in persons who are obliged to use the hand under conditions of rapid change of temperature, as in washing, is explanatory of the foregoing condition.

Prognosis. The outcome is usually favorable if the exciting cause can be removed. It not infrequently happens, however, that such disordered sensations persist for many years, suggesting a low-grade neuritis.

Treatment. The patient should abstain from the kind of work or the conditions under which the affection develops. If no such exciting conditions are discoverable, the difficulty must be treated on the general principle that the local affec-

tion is a manifestation of a general disorder. It will often be found that hygienic measures combined with tonic drugs, electricity and massage are efficacious. It is important to protect the hands as far as possible from the extremes of heat and cold and of moisture and dryness.

Case 105. O., a man of thirty-two, three years before being seen had had an unexplained gastric disorder. While working, he had had a sudden attack of vertigo without confusion. He vomited. A little later, he had a very similar attack, first a feeling of discomfort followed by dizziness and a period of vomiting lasting for two hours, much of it bile. There was also very great nausea and general discomfort. He had continued to have such attacks at irregular intervals for three months. He had then improved somewhat. He was treated by a physician for two years, primarily for the stomach condition, with absolutely no relief. On one occasion while using a desk telephone with his eyes fixed on a bright light he suddenly had a violent attack of vomiting. Thinking from this that his eyes might be the source of his difficulty, he consulted an ophthalmologist, who corrected a refractive error. He was somewhat improved by wearing glasses. Later, while reading in a train, the car in which he was sitting suddenly seemed to bend over. He closed his eyes and when he again opened them, everything appeared normal. His stomach was secondarily affected. This attack evidently differed from those he had had before. He was from this time disturbed by quickly passing objects, such as trains or automobiles. Thereafter he had repeated more or less abortive attacks, some resembling the original ones and others consisting merely of peculiar sensations, occasioned, for example, by looking down or intently at objects; but these, in general, were relatively slight and could, he thought, be overcome by certain devices which he practiced. Further correction of the eyes seemed to help somewhat. At length he had a violent attack beginning with a feeling of discomfort in his head, followed by excessive vomiting, with persistent vertigo. This he regarded as one of the worst he had had.

When seen, following this attack, the examination showed that he was distinctly deaf in the left ear and had had tinnitus on that side for two or three years. He gave no history of general headache or of vomiting, apart from the vertigo. He was somewhat nervous in manner and naturally discouraged. He had never lost consciousness in any attack and had never actually fallen, although he might have done so had he

not lain down. He did not smoke, and drank to a very slight extent. The knee jerks were active. In general, apart from the deafness, there was no discoverable disorder of the nervous system.

He was referred to an aurist, who regarded the vertigo presumably as aural in origin. The treatment at first was middle ear inflation, which resulted in no material benefit. When seen three months and a half later, attacks of dizziness with vomiting persisted, although not so severe as previously. His appetite and sleep were satisfactory. The pupils gave a good light reaction. The fundus was clear, the outlines of the disks distinct, with no trace of swelling; the heart was normal; pulse regular, 64. He had had no scotomata associated with his attacks of vertigo. Fixation of the stapes was demonstrated and the left-sided deafness became practically complete. The stapes was finally removed with complete cessation of symptoms up to the present time.

Diagnosis. This patient undoubtedly suffered from Auditory Vertigo or Ménière's disease, due to disturbance in the internal ear through fixation of the stapes. In this case, the patient was treated for two years for a supposed primary stomach disorder. Had an aural examination been made, this unfortunate mistake presumably would not have occurred. The differential diagnosis from gastric disease is sometimes difficult but should, as a rule, be determined by the periodic character of the attacks, by the absence in the free intervals of demonstrable stomach disorder and by the presence of deafness, usually with tinnitus associated with vertigo. The differentiation from epilepsy is determined by the absence of convulsive movements in auditory vertigo and also, as just stated, by the actual presence of disorder of hearing. The vertigo of brain tumor is rarely so paroxysmal in character and is usually associated with changes in the optic disk and other signs of intracranial pressure. In all conditions of paroxsymal vertigo, particularly if accompanied by vomiting, a painstaking aural examination should be made.

Prognosis. The patient will undoubtedly remain free from vertigo, provided the other ear does not become affected. In general, the outlook for relief of the vertigo is good when

complete deafness supervenes or when deafness is induced artificially by the removal of the stapes. Less radical treatment, such as middle ear inflation, is usually not of permanent service.

Treatment. As already indicated, the treatment may be either palliative, when it is usually inefficacious, or radical, through operation, by removal of the stapes, which often results in complete cure. A contra-indication for surgical intervention is involvement of both ears, unless complete deafness be considered preferable to the vertigo. Lumbar puncture has been done as a means of relief.

Case 106. L., a married man of thirty-three, a blacksmith by occupation, a year before had begun to suffer from pain in the sole of the left foot; this had lasted for about three months and then ceased; nine weeks before being seen the toes and the foot became perfectly white and cold. This appearance changed from time to time to a distinct flushing of greater degree than normal, with a persistence of the sensation of cold, though not so extreme as when the foot was pale. In general the foot was apt to be flushed indoors, and pale out of doors. The pain occurred for the most part at night, starting about nine o'clock, and often assumed a high degree of severity. The other foot and the hands had not been affected. He had never frozen his feet but had noticed a tendency to sweating; he had worked in a dry place. Ten days before his visit, he had noticed a blister on the under side of the right great toe. Pus formed; the ulcer was opened but had not healed since.

Examination showed pupils normal to light and accommodation; normal wrist and knee jerks; a normal and regular pulse of 80. The right foot was flushed; the dorsalis pedis artery was not palpable; sensibility was unimpaired; all movements were possible. There was a large open ulcer on the under side of the right great toe surrounded by much dead skin. Between the small and next toe, there was also an ulcerated surface of similar character. He had twinges of pain during the examination.

Diagnosis. This case is to be classified as a trophic (vasomotor) disturbance analogous to, if not identical with, Raynaud's disease. Its unusual feature is its limitation to one foot. Raynaud's disease, or so-called Symmetrical Gangrene, ordinarily begins in the hands and is bilateral in distribution. It occasionally happens, however, that a similar process occurs in a single extremity, as in this case. The trophic disorders of tabes do not involve the vasomotor system in this way. The formation of painless ulcers in that disease is common, with small tendency toward healing, but in such cases the general sensibility of the foot is involved, and other signs pointing to tabes are present, as, for example, pupillary changes, lost deep reflexes, and general sensory disorders.

Prognosis and Treatment. The condition often improves spontaneously, but with a constant tendency to recurrence and a reopening of apparently healed ulcers. Drugs are unavailing. A tourniquet applied to the leg and quickly released occasionally brings relief, after the method advocated by Bier.

Case 107. O., a woman of thirty-four, a teacher by occupation, always worked at high tension; she had had in the past various nervous disturbances with temporary incapacity for work, and in general regarded herself as a person of nervous temperament. For a year she had had slight twinges of pain in the distribution of the right fifth nerve; at first the upper (supra-orbital) branch was more affected; later the pain extended to the lower branches; she continued at her work. The pain, however, was so persistent that she consulted a rhinologist, who said that there was no source of irritation in the nose. The eyes had also been examined, with negative result. Her hearing was unimpaired; her teeth had been drawn on the upper jaw on the affected side. The week before being seen she had worked particularly hard, and had also been exposed to draughts. The occurrence of menstruation also seemed to render the pain worse; the discomfort was not constant, but the pain occurred in violent, short attacks localized about the nose and lower jaw. She had difficulty in speaking and eating on account of the excitation of pain. She had taken castor oil without definite effect, as well as bromide of strontium, and hyoscyamus. It was finally necessary to resort to small doses of morphine. Rest and cessation of work was ordered, and this seemed to bring some relief; at one time she had had a respite of two weeks. On her own initiative she had finally had all but three teeth drawn in the lower right jaw.

During this period of enforced rest, she wrote as follows: "The third and most awful seizure of tic has been using up my vitality for the last nine days. A quarter of a grain of morphine with atropine had no effect. It was necessary to have two such hypodermics during a night, together with trional and other strong quieting things. Resting under such conditions is not simple." And again a little later: "The limit of my endurance of suffering is approaching; the serious attack of tic that I had the first of July lasted until the 19th of August. The following two weeks I was about, driving, tramping, and able to talk naturally. The relief at that time we supposed was due to the discovery and removal of a stony growth, — a pulp nodule in the nerve cavity of the cuspid

tooth; the tooth was devitalized and the growth removed. Then I took a slight head cold, the inflammation from which pressed on the trigeminal and caused tic. Upon further consultation with the dentist and the doctor, it seemed advisable to have the wisdom tooth extracted from that same right side. We found that the tooth had a large extra prong or root, which may have irritated the nerve. However, the extraction of it so disturbed or bruised the nerve that I have had all those terrific paroxysms ever since; that is, for the last twelve days. I had morphine for four days, but nothing since."

The pain persisted at intervals, in spite of medication and such measures as detailed above. A careful and painstaking regulation of her digestive functions apparently helped the situation for a time and reduced the attacks of pain. She gained somewhat in weight, and in general her physical condition was temporarily greatly improved. The pain, however, recurred in distressing form, and alcohol injections into the nerve at the hands of a skilled operator resulted in a decided amelioration of the pain. It was deemed unadvisable to undertake the more radical operation of removal of the Gasserian ganglion, or deep section of the offending nerves. In general, the patient was greatly benefited by the less radical procedure, and, so far as known, has lived in moderate comfort since.

Diagnosis. This is an instance of Trigeminal Neuralgia (tic douloureux) occurring in a somewhat young person of decidedly nervous temperament. The sharp localization of the pain, its paroxysmal character and its extreme intensity absolutely exclude it from the category of a simple neurotic disturbance. The etiology is obscure; there was no evidence of a sufficient local source of irritation in the nasal cavity, in the sinuses or in the teeth to account for the pain; therefore, as in many of these cases, the cause of the neuralgia must be sought in the general condition of the patient rather than in a definite local source of irritation. The extraction of the teeth clearly did not remedy the condition, and it is altogether doubtful whether this frequent source of facial neuralgia was in any way operative in this case.

Prognosis. The patient improved greatly after benumbing the nerve through injections of alcohol. It is probable that the pain will recur at intervals during life, very possibly demanding radical surgical procedure for its ultimate relief.

Treatment. In this case the usual preliminary measures of treatment were undertaken without definite result. The bromides, and, later, morphine, were administered, together with large doses of castor oil, which is often an efficient remedy. Careful examination was made of the teeth, of the eyes and of the nasal cavity as possible sources of irritation; the digestive tract was most carefully regulated, resulting in a gain of weight; but all these measures failed to relieve the facial pain. The mechanical method of injecting alcohol into the nerve proved temporarily efficacious, as it must invariably do, if the nerve is reached by the injection. No further operation was attempted, in consideration of the youth of the patient, and of the fact that the pain in any event was not constant.

Case 108. G., a man of thirty-five, had worked hard for five years under trying conditions, with few vacations. A month before being seen, he was depressed, stopped smoking and drank black coffee, but without special effect on his spirits. About a week later he noticed pain about the left side of the body at the level of the umbilicus. This was followed in three or four days by an eruption in the same area in which he had had pain. He became increasingly nervous and stayed away from his work for a number of days. He was waked at night by the neuralgic pain. So far as he knew, he had had no fever at any time. When examined, between two and three weeks after the onset of the neuralgia and eruption, he appeared exhausted and in poor condition. He thought his attention was defective, his sleep had been much interrupted, the neuralgic pain in his back had gone, but he still had superficial discomfort with a sense of stinging. His bowels, previously constipated, were now normal. He was drinking very little alcohol.

The physical examination showed pupils normal to light and on accommodation; normal heart, with a regular but somewhat rapid pulse. The knee jerks were also normal. A definite herpetic eruption, partially healed, extended about the body on the left side at the level of the umbilicus.

When seen again at the end of a week, he had improved in every way. He slept satisfactorily; the intercostal pain was better and the eruption was disappearing. He was able to walk and also to work, and his appetite was good.

Diagnosis. The patient was suffering from Herpes Zoster, involving the distribution of one and a part of a second intercostal nerve on the left. Previous to the appearance of the eruption, such cases are often regarded as simple neuralgia. In intercostal pain, therefore, a careful inspection of the body should be made not only at the time of the first appearance of pain, but also later in order to determine the presence of an herpetic eruption. The eruption itself, limited to one or more nerve distributions, is not to be mistaken for other lesions.

Prognosis. The disease is self-limited and, as in this case, tends to spontaneous recovery.

Treatment. The treatment is palliative rather than curative. The preliminary pain may be treated by the milder analgesics, followed, if necessary, by codeine or morphine. When the vesicles appear, they should be carefully protected from overlying clothing and dusted with a simple powder, such as oxide of zinc. Surgical cleanliness should be insisted upon. The later stages are best treated by means designed to build up the general resistance and to insure such physical comfort as is possible. In this case, galvanism applied about the body and bromide of potassium in doses of from 10 to 20 grains at night, together with encouragement and explanation, sufficed to accomplish excellent results.

Case 109. (*A.*) I., a man of fifty-three, had worked as a stone-cutter for many years; three years before being seen, he had had some difficulty with his hand, which, however, quickly recovered, and he was able to return to his work. A few months later, after a period of idleness, he began to work again, and then noticed pain in the thumb, wrist and back of the left hand, running up the arm; this pain recurred only when he was at work, and finally became so troublesome that he was unable to hold the tool used in stone-cutting in the left hand; for this reason he was obliged to give up work. He had a feeling of numbness in the thumb, but physical examination of the arm and hand showed no objective abnormality. The pupils, knee jerks, reflexes, motility and sensibility were all normal.

(*B.*) A woman of forty, unmarried, had for ten years done much work with her arms in the nature of gymnastics and massage; at the end of eight years she had experienced a gradual onset of weakness and sense of heaviness, together with trembling of both arms; the sensation was as if "they were going to sleep." She gave up her work for six months, and appeared to be relieved temporarily by vibratory treatment; she then returned to work, and had been active since. She thought she had not grown worse, but constantly noticed the unpleasant sensations referred to, after finishing a treatment of massage. She was somewhat tired and of nervous temperament, but in general well; her sleep was reasonably satisfactory, but she often took trional. She suffered from constipation. Apart from the disturbance in her arms and a coincident difficulty in writing, on account of tremor and pain, she considered herself well. The physical examination showed a considerable degree of tenderness over the nerve trunks of the whole right arm; both active and passive movements were free, and there was no disorder of objective sensibility or of motility; the knee jerks were active, the pupils normal, the pulse 120; she was excitable in manner. At a later visit she showed general improvement in her nervous condition, but her arms were no better; she was continuing to give massage.

(*C.*) A married woman of thirty-two, after a period of

excessive piano playing, noticed a tingling sensation, with some sense of throbbing in the right upper arm; the left arm was also affected in a similar way, but less severely. She had played the piano persistently for many years, and on a previous occasion had had a similar trouble to that for which she was seeking advice. She was in general well, but had little endurance; housekeeping and the care of her children were irksome, but she had no real anxieties; her appetite and sleep were satisfactory. She had worried considerably lest the difficulty in her arms should prove to be serious. She also had similar sensations when she wrote, and she was in general worse when tired or when she used her arms. Examination showed no objective disorder, either of sensation or motion; the faradic irritability of the muscles was retained.

(*D.*) A man of forty-seven had during the greater part of his life worked as a bookkeeper; up to a year and a half before being seen he had written steadily and without discomfort; he then noticed that writing was done with increasing effort and that he was obliged to grasp his pen tightly in order to write smoothly; this had grown worse; he had much feeling of discomfort, particularly in the flexor muscles of the forearm. He was well in other respects, and was able to do other things with the hands without discomfort. His writing had been reduced to not more than half an hour a day, excepting for one day at the end of each month. He had tried various forms of treatment without avail. The pupils and knee jerks were normal, and there was no objective disturbance, either of sensation or motion in the hand. He complained particularly of pain running up the right arm, for which there was no discoverable objective cause.

Diagnosis. These four cases illustrate types of Occupation Neuroses. The diagnosis is made from the onset of localized pain and incapacity in certain groups of muscles used constantly for the same or similar purposes. It is of interest, that in Cases B and C writing was difficult, as well as the special work which induced the disturbance, showing that in some cases at least the sharp limitation of the disorder to groups of muscles concerned in a specialized form of work is rather apparent than real. The etiology of these conditions

is not definitely determined. Over-use of muscle groups appears in all cases to be a predisposing factor; whether a low grade of neuritis results therefrom, through pressure or other cause; whether the condition is rather to be explained by a disorder of the cerebral mechanism; or whether, as seems most probable, both the peripheral and the central disturbance must be considered in combination, are matters as yet not clear.

Prognosis. The outcome of the various forms of occupation neurosis, as exemplified in the foregoing cases, is satisfactory, provided the special form of muscular work which induced the disturbance be discontinued.

Treatment. Treatment consists in the removal of the cause. The patients should be, and were in the cases quoted, advised if possible to give up their specialized work and to find other employment. Psychotherapy and drugs are of relatively little avail. Cessation from work and rest of the affected muscles is absolutely demanded.

SECTION V.

PSYCHONEUROSES.

In classifying the following cases as "Psychoneuroses," that term is used in a comprehensive sense as including those conditions the explanation of which is dependent upon a primary appeal to psychic factors. It has become increasingly apparent that the search for a physical pathology in affections of this type has been far less productive of clear understanding than an appeal to mental causes. The result of this latter tendency in investigation has been a more painstaking analysis of mental states, with an accompanying recognition of their etiological significance, and a consequent wider separation of neuropsychoses from the structural or presumably structural diseases of which examples have been given in the preceding pages. There can be little doubt that a candid acknowledgment of the psychogenesis of the so-called functional diseases will go far toward clarifying our understanding of these hitherto obscure and elusive affections.

Case 110. C., a married woman of forty-one, without children, gave the following history: As a child she was not strong; as early as the age of twelve she became possessed with the idea that she had a cancer under her tongue, and suffered extremely from the idea; she, however, told no one of her difficulty. As a girl, she was morbid, and worried constantly about the future, but in spite of this managed to enjoy life. Her anxiety tended always to be directed to herself and her own condition; she was married at the age of about twenty-eight, and thereafter underwent what she called an attack of "nervous prostration." She felt unnatural, and the ordinary duties of her daily life seemed almost impossible; she felt at times as if she were destined to be deformed, because she had pain in certain joints. She lived thereafter in constant fear of incurable disease, and was much depressed

thereby. All her anxieties, however, appeared to have some basis, though invariably inadequate, in her physical condition.

The difficulty for which she particularly sought advice had resulted from an interview with her physician about a year previously; she was at that time apparently suffering from a slight cold, or bronchial irritation, and after examination her physician remarked that she " had some roughness of respiration," and advised her to spend her summer at an inland place rather than near water. She asked no questions at the time, but forthwith became possessed with the idea that her physician thought her ill with tuberculosis. She suffered extremely from this idea and finally consulted a man of high reputation in regard to tuberculosis, who examined her with the greatest possible care on more than one occasion, and reached the conclusion that her lungs and throat were entirely free from the disease. She had no expectoration or distinct cough, but complained of " awful feelings " about the neck and throat, and, in spite of reassurance, was completely overmastered by her fear. She slept badly and her mind was constantly absorbed by her anxiety. For a year past she said that she had not breathed or coughed without noticing the effect on her chest.

When examined she was exceedingly depressed in manner, emotional, and continually asserted that she had, or would have, tuberculosis. This idea she justified by the character of her sensations, particularly referred to the throat and chest on the right side. Her throat, she said, was dry, and she continually justified the idea of throat irritation by a manifestly artificial cough, which resulted in no expectoration. In general she was physically well, and showed no sign whatever of any cachexia. Apart from her extremely introspective attitude and tendency to apprehensiveness, she was perfectly normal both physically and mentally.

She was seen a number of times thereafter, for a period of a month, with slight variation in her symptoms; it was, however, absolutely impossible to dislodge her fixed idea for any length of time, in spite of long-continued explanation and argument. Another visit to the specialist in tuberculosis, in whom she professed much confidence, resulted in nothing

more than a temporary amelioration of her morbid fear. A characteristic remark made at this time was that "she would not mind the sensations through her chest, were she sure the condition was not going to grow worse."

Diagnosis. It is difficult to label a neurosis of this type, but it illustrates well the condition known as Hypochondriasis, characterized particularly by a fear of physical disease. The etiology in this case was not determined further than that from childhood the patient had been a victim of morbid fears, directed toward herself, and chiefly of a physical sort. The underlying cause of these primary fears was not ascertained, though it is altogether probable, with a more complete analysis, that certain exciting factors might have been elicited. The fact desirable to point out here is that such a condition beginning in childhood is likely to develop with advancing years and increasing responsibilities, often assuming different forms as new conditions arise. The suggestibility of this patient was very great in matters regarding her own physical condition, as shown, for example, by the effect of an inadvertent remark of her physician regarding her breathing, which she forthwith misinterpreted to her own disadvantage.

Prognosis. The patient disappeared from observation without permanent relief. The outcome depends upon a reconstruction of her life and mental attitude, which, considering the circumstances under which she lived, is likely to prove exceedingly difficult. It is probable that the fear of tuberculosis will give place to some other anxiety as time goes on; but complete relief cannot be expected until the tendency itself toward introspective anxiety is permanently allayed; this can only be accomplished by painstaking psychotherapy.

Treatment. An attempt was made in this case to explain the nature of the difficulty in great detail in the hope that thereby she would be able to overcome her morbid feelings. Activity was also insisted upon in the hope of sidetracking her emotional state; the results were disappointing. Temporary relief was apparent, but it was impossible so to impress her with the nature of the difficulty that she was able to carry

on her cure unaided. When last seen the idea of tuberculosis, although not appealing to her reason, was still firmly fixed as an emotional state in her mind.

Case III. A., a man of twenty-seven, married, was employed as a fireman in the Boston Fire Department. His main complaint, which he admitted with some diffidence, was that he was unable to bear the rays of the sun, wholly irrespective of the general temperature. He had been to various physicians, who had considered him "nervously run down" and had prescribed for him, but to no effect.

The history, procured with some difficulty, was as follows: He had been married upwards of three years. His wife had had one child, born at the eighth month; the labor was difficult and the child lived three months. Ten or twelve years ago he had had an attack of what he called malarial fever. Two years ago, in July, during an exceedingly hot period, he had had a similar attack. He was then out of work for twenty-nine days and when he returned, although otherwise well, he had an uncontrollable feeling that he couldn't stand the heat of the sun. He felt, as he expressed it, "as if the sun went through him and as if he were going to fall to pieces." As winter came on, he continued to be affected by the sun and also began to be troubled to a certain degree by artificial heat.

This situation seemed so unusual that a further attempt was made to determine more in detail the condition at or about the time of the beginning of his neurosis. It appeared that he was first taken sick when on an excursion. The most notable symptom was a sense of pressure in the epigastrium. This lasted all day. In the evening, he smoked a cigar and felt better. He went to a large fire in the course of his duty, but was unusually troubled by the smoke and was relieved from duty. He was told by his friends that he looked badly. A few days later he had a similar attack to the one described above. It was on a very hot day; he went home and sent for a physician, who at first diagnosticated indigestion and later, after examination of the blood, malaria. He had another similar attack, but gradually improved and was working at the end of a month, but felt exceedingly weak. The following summer he began to improve somewhat but was far from well. He was able to stand for a time in the sun, but during the summer avoided doing so as much as possible because of the un-

pleasant sensations of weakness and distress which it occasioned. He was still able to do his work and, in fact, enjoyed the excitement of a fire. It had been a source of great disturbance to him that he could not explain why it was possible to go through various experiences of extreme heat and fire and yet be absolutely incapable of standing the rays of the sun. On one occasion, for example, in winter, when it was four degrees below zero, he had the same distressing sensation. Added to this, there developed a distinct fear of closed places and of crowds. On one occasion he felt himself absolutely unable to go through a crowded street. He was not alcoholic, his appetite and sleep were not impaired. He had, however, worried extremely; he felt as if he " might as well be dead "; that " life was a burden." In trying to combat these feelings, his courage failed and he was unable to accomplish results. He was cheerful in manner and showed no signs of depression beyond the general anxiety which his increasing incapacity occasioned him. Actual nervous strains did not, however, affect him. On one occasion, he narrowly escaped with his life in an explosion, but was not at all disturbed thereby. On another occasion, when many horses were burned, he was obliged to stand on the carcasses of the horses in attempting to put out the fire, and this also he did without flinching. During this period, however, he felt himself unable to go to the theater, although he had the tickets, because of the closeness of the air. He also found it impossible to sit in a certain chair which had been used during his illness with malaria, and felt impelled to go to another room and open the windows wide, whatever the outside temperature might be. He was accustomed to work in a small, hot room under conditions of great discomfort without the slightest difficulty, but, as he expressed it, he was " all gone " when he went out into the sun. A consumptive girl of his acquaintance sat much in the sun. This made him increasingly eager to avoid the sun himself and he wondered how long he could live if she, in the sun, would live only a few months. He wondered if he would be in this condition of terror till he died. He feared greatly another attack of malaria.

Still entirely dissatisfied with the analysis, further questions

were asked regarding the attack of malaria two years before. The memory was not easy to arouse, but finally, after much questioning (the method of free association was not used), the simple fact came out that during the time of his high fever and discomfort from malaria, the weather was exceptionally hot, the temperature being well over ninety for a number of days. The combination of his fever and the excessive heat, together with the fact that a misguided woman was continually quoting the readings of a thermometer, constituted a situation associated with great physical and mental suffering. It was at once clear that when the fever subsided and the temperature decreased, the sense of debility and actual fear of the sun was invariably aroused when he became conscious of the sun's rays. It was only necessary for this one element in the association to be excited to reproduce the entire distressing experience of his illness.

The matter was explained to him at length, in language suited to his understanding, that he was suffering from the reproduction of an experience through which he had actually lived and from which he had suffered, but that, one element at least — the malaria — no longer existing, there was no reason why the distress occasioned by the combination of sun and fever should persist. He went away with this explanation and nothing more in the way of treatment.

Although the attempt was made to learn of the outcome of his difficulty, it was not possible to have another interview with him for the space of three years. He then made the following statement. He had thought the explanation given him reasonable, but for a time, although he was helped, he was still annoyed by the sun. He, however, met the difficulty in a much more philosophic spirit and had been distinctly benefited by the explanation given him of the genesis of his difficulty. He had continued his work as fireman and, after about three months of effort, following a short vacation, he had improved rapidly. He said that he was not " bothered a bit by the sun " except on very rare occasions, when he had a certain slight recurrence of his old feelings. He was in no way incapacitated and had continued in the arduous work of a fireman.

Diagnosis. The foregoing case is a type of the "Anxiety Neurosis," based, so far as the analysis went, on an association between the distressing sensations caused by a high fever and the rays of the sun during a period of extreme heat. Recovery from the febrile condition took place, and the extreme physical heat was also of short duration; the association between the two conditions was such, however, that whenever he was exposed to the rays of the sun, the entire distressing series of events was reproduced in consciousness, with the result that he had continued attacks of, to him, unexplained anxiety whenever he found himself in the sun, characterized by a feeling of prostration, extreme apprehensiveness, sense of weakness and incapacity, combined with a high degree of dread, which rendered him practically helpless. Diagnosis was made through a relatively superficial analysis of the patient's life, and the discovery thereby of an adequate cause for the subsequent distressing and increasing neurosis.

Prognosis. When this patient presented himself he was in an extremely discouraged state, and about to give up his work, which he felt he was rapidly becoming unable to accomplish. Had the cause of his peculiar fear not been found, he would inevitably have been obliged to change his occupation, and undoubtedly would have become a nervous invalid. The prognosis, therefore, in this case, depended wholly upon a proper analysis of the neurosis in relation to its causative factor. This being found, the outlook for the future is absolutely good.

Treatment. The treatment in this case consisted in an effort, which proved successful, to discover the cause of the phobia. The explanation following this discovery proved entirely adequate to remove the anxiety, which had so far taken possession of the patient that his work and livelihood were threatened. The fact that he has been well for a period of upwards of three years is sufficient demonstration of the correctness of the therapeutic measures undertaken in this case. No drugs were given, and the patient was seen only once.

Case 112. L., an unmarried woman of twenty-one, a kindergarten teacher, had been troubled with uncontrollable twitching of the head some years before being seen; this had developed suddenly, and was temporarily a source of great annoyance; she had not been strong for a number of years; had always had a small appetite, and had had much discomfort at her menstrual periods; she had studied faithfully for two years in preparation for her work, which, however, was not difficult or irksome. Shortly before being seen, and without apparent exciting cause, twitching of the muscles about the head and face had begun again, with renewed vigor. As she lay in bed her head was in almost constant motion, with a tendency to turn toward the right, due to a sharp and almost constant spasm of the left sternomastoid muscle; the right sternomastoid was also involved, but in less degree, as were also other muscles about the neck. The jaw muscles were in a state of clonic spasm, and the left trapezius was said to have been affected, especially at night. The pupils and cranial nerves were normal; the pulse was 80, and the heart showed nothing remarkable; the knee jerks were normal, and definite signs of hysteria, such, for example, as hemianesthesia, or other marked sensory or motor disorders, were lacking, with the exception of the extraordinary spasmodic movements to which reference has been made. It appeared that these movements did not persist in deep sleep but were present when she was sleeping lightly. There was complaint of considerable pain about the neck and back of the head, due undoubtedly to the constant muscular contractions.

In spite of very large doses of bromide, with codeine and a small amount of hyoscine, which led to a certain degree of gastric disturbance, with vomiting, the spasmodic movements continued and increased in violence, with the involvement of more muscles; on one occasion, for a period of three hours, after a rather sudden onset, the movements became so violent that the bedclothes could not be kept on, and the suffering from the violent muscular contractions was extreme. A doubtful hallucinatory state, presumably due to the large amount of medicine administered, developed, but in general

the mind was perfectly clear, and capable, in a measure, of controlling the spasm. When the patient was seen, following this period of motor disturbance, she was exhausted and drowsy, having some difficulty in speech from the muscular spasm, and a very slight and somewhat doubtful appearance of external strabismus.

She was transferred to a hospital, where she remained, under close supervision and careful nursing, for one week, with constantly diminishing attacks of muscular spasm. Further investigation during her stay at the hospital disclosed various obsessional traits, an example of which was a marked dislike of food, associated with a feeling of more or less disgust; this was traced to an experience at the age of eleven, when she was forced to eat calves' brain, which she forthwith vomited. She also had a curious and unexplained dislike to a member of her family, whose presence, she said, "made her nervous"; she had had two love affairs, the first somewhat disastrous, and the second still going on; her home life was, in certain respects, uncomfortable; she was extremely sensitive and on the whole uncommunicative. She felt that the muscular spasm relieved her nervous tension. At the end of the week, she left the hospital practically free from the spasmodic movements; on returning home she was able to control the spasm by the exercise of much determination. She was, however, unable to get over her obsessions, although they no longer dominated her; she went on with her work. Thereafter she improved; had good nights, and increased in her capacity of self-control. A very recent report stated that she has lived a useful life for the past two years, and is practically free from the affection for which she first sought relief.

Diagnosis. This case may properly be included under the Hysterical affections; the violent spasmodic movements limited to certain groups of muscles, irregular in onset and wholly beyond the control of the will in their most extreme manifestations, point toward this diagnosis. Chorea is to be excluded because of the peculiar limitation of the spasm, together with its violence, which, except in rare instances, does not occur in choreic affections. Its resemblance to an

extensive tic should be noted, but here again the character of the onset, and the associated conditions, together with the rapid improvement under treatment, render the diagnosis of Hysteria much more probable in spite of the fact that other physical signs of that neurosis were not manifest.

Prognosis. The patient improved greatly under the treatment detailed below, and undoubtedly, if proper conditions can be secured, will lead a useful and active life.

Treatment. The only effectual treatment in this case was an appeal on the mental side; the primary administration of bromides, codeine and hyoscine were entirely inefficacious, and, in fact, during their administration the difficulty increased rather than diminished; when, however, she was removed to quiet surroundings, away from the family influences, and treated by psychotherapeutic means, improvement was striking, and apparently has been lasting. The attempt was made to analyze the patient's life and mental state, with the object of determining the possible sources of her later neurotic manifestations; this attempt met with partial success, as indicated in the history; with this knowledge it was possible to explain, in a measure at least, the origin of her symptoms, to assist her in the effort at self-control, and to indicate the direction in which self-discipline should be exercised. She was a person of much intelligence, and appreciated both the reasonableness of the explanation and the necessity of personal effort. The result seems to have justified the expectation of relief by this means.

Case 113. C., a woman of thirty-two, unmarried, had always been well although of a somewhat nervous temperament; she had, up to the time of her present difficulty, never had attacks of hysteroid character. Three days before being examined, while attempting to go on board a steamer, the gang plank on which she was standing slipped, causing her to fall with the plank ten to fifteen feet; she was able to cling to the plank, but was immersed in the water up to her waist; she was bruised, and suffered, as she said, "a violent nervous shock." She was taken home and was in a reasonably normal state the following day; the next day, however, she was worse, and, according to her family, had attacks of opisthotonos. When first examined her general appearance and manner was of a person under considerable nervous strain. She was slender in build, languid in manner, and at times appeared as if in pain. Her facial expression was somewhat unnatural, due partly to a constant opening and closing of her eyes. Her chief complaint was of the right side of her neck. The condition of the patient was such that a complete physical examination was not undertaken at the first visit. The following facts were, however, noted. There was a bruise on the right elbow, and a large ecchymosis on the upper and under part of the left thigh, which was tender. There was also a sprain of the right ankle; the pulse was 80 and of fair quality; there was a slight but definite left hemianesthesia. While being examined she had a typical hysteroid attack, with opisthotonos, lasting about three minutes. There were no convulsive movements, and an attempt to abate the attack by verbal suggestion was unavailing. She presumably did not lose consciousness.

At a second visit, a few days later, the patient was found lying with her eyes closed, in an apathetic, half somnolent condition, from which, by degrees, she was completely aroused, and appeared bright and relatively well, except for occasional complaint of pain about the back of the head. The attacks of opisthotonos had decreased somewhat in number, but not in severity; her sleep had been poor.

Physical examination showed the following conditions: there were painful points on deep pressure at the back of the

head in the region of muscular insertions below the occipital protuberances, also at the inner border of the left scapula; passive movements of the arms were unhindered, except by some reference of pain to the neck; the grip of the right hand was diminished, probably on account of pain; there were no tremors; there was tendency to foot-drop on the right, and passive movements of the legs occasioned pain, both in the thighs and legs; the knee jerks were active and equal; plantar response was normal; no abdominal or epigastric reflex was obtained. The heart was normal and slow in action; the pulse 64, of good quality; the pupils reacted normally, but by rough test there appeared to be a concentric narrowing of the left visual field; general sensation was reduced on the left side, particularly in the leg; the arm was not affected, nor was the upper part of the chest and face, in contrast to the earlier examination, when the hemianesthesia was complete; there was considerable complaint of vertigo, particularly when raised in bed, and when her head was suddenly turned; she felt tired and exhausted after being lifted. As time passed, the attacks of opisthotonos grew constantly fewer; on the other hand, she became more nervous and emotional and was greatly disturbed by the whistle of a steamboat. She began to sit up; talked somewhat more freely and with less effort, but still complained of exhaustion and weakness. There were various complaints of pain; a partial hemianesthesia persisted, and there was apparent great loss of strength in the right hand, to such a degree that complete flexion of the fingers seemed impossible; thereafter there was much nervous disturbance of a general sort; she was up and about, but the smallest effort gave rise to various symptoms, such as "a floating sensation," nausea, globus hystericus, a sense of suffocation; the former anesthesia gave place to a partial disturbance of sensation in the region of the right ulnar nerve of the hand; the nerve trunk at the elbow was also painful on pressure; she had "cold and hot flashes," attacks of trembling, great emotionalism, much pain in the back of the head, shooting over the eyes; tremor of the eyelids, and what she called "fainting attacks." An attempt to elicit the knee jerk on the left

led to great complaint of pain in and about the joint, and much general reaction.

At a later examination the anesthesia of the right arm, previously noted, had extended up to the shoulder; there was another area of anesthesia over the right chest. Several months elapsed, with general improvement, so that it was possible for her to attend to her work to a certain extent, which was manual in character; she was mentally more stable, but continued to complain of pain at the right elbow, and with disturbance of the left leg. She had not ventured out alone; her sleep was poor, her appetite good, the bowels constipated. These symptoms continued, with variations, and new ones were added. Her statement at this time was as follows: She had not been able to work because of lack of strength; she felt sick "all over" if she attempted to work; her right arm felt cold and weak; she felt that her "courage was breaking"; she had had one or two typical hysterical attacks; she had a particular dread of the water; she suffered also from "clammy sensations," and her whole left side felt at times rigid, "as if starched." Examination of the urine showed no significant abnormality. She had lost about ten pounds since the accident.

The case was later adjusted in the courts, and decided improvement followed; but at least for some years there was not a complete restoration to her former state of health.

Diagnosis. So far as known, this patient was well before the relatively trifling accident stated in the foregoing account. Immediately thereafter symptoms of a nervous character developed, many of them of an hysterical sort; the situation was complicated by a suit for damages against the steamboat company. The diagnosis, therefore, of Traumatic Neurosis is entirely justified. It was evident from the first that there was no underlying organic cause for her various and varied disturbances. The diagnosis of such a neurosis is usually not difficult, coming on as it does after an accident, and usually, though by no means always, associated with litigation.

Prognosis. The outcome of neurotic disturbances due to injury is varied, depending upon the various emotional

influences brought to bear upon the patient. True simulation is rare, but exaggeration of symptoms, partly conscious and partly unintended, is a constant accompaniment of this type of disturbance. In estimating the prognosis, therefore, it is essential to take into consideration the temperament of the patient, the character of the lawyers concerned in the transaction and the various factors entering into the litigation. Although in this case the symptoms were by no means simulated, it is not to be questioned that the pendency of litigation and the gain to be secured by a persistence of symptoms was influential in keeping alive the neurosis, although it was not its cause. Improvement began before the settlement of the issue, but progressed very much more rapidly after somewhat liberal damages were finally awarded.

Treatment. Treatment is unavailing until the suits in such cases as this are settled. The inherent dread of court proceedings, the frequent examinations of physicians, often antagonistic to the patient's interest, and the general usefulness to the patient of exaggeration, all tend to thwart efforts at systematic relief. When the suit is settled, definite progress may be made toward restoring the nervous equilibrium by the means employed for other neuroses due to a different cause. In this case great improvement, which had begun before the settlement, progressed in a greater degree after it. The case has not been followed to this time, but when last heard from showed an improvement which promised complete restoration of usefulness.

Case 114. A married man of fifty-seven, a mechanic by occupation, sought advice for a peculiar difficulty, particularly associated with writing. The history, in brief, was that, at the age of twenty, he was unexpectedly asked to sign a certain legal document. This he was able to do, but he was much perturbed and excited by the unusual request and also greatly embarrassed while he was writing because several men who were standing about made jocose remarks at his expense. From that time on, whenever he was called upon to sign his name or write in the presence of others, he became so excited and his hand trembled to such a degree that he found it extremely difficult to continue. He was, however, able to write perfectly well when persons were not looking on. For many years his difficulty was practically confined to writing, but about six years ago, and thirty years after the onset of his trouble, when called upon in connection with his employment to do a piece of stitching, he noticed the same nervous trembling which had so long hindered his writing, and this also he has been wholly unable to overcome since. As with the writing, he is able to stitch or do other work properly when he is alone and undisturbed, but if persons are waiting for the work to be done, or if it must be completed at a fixed time, he finds himself incapacitated. A strong determination to accomplish what he has to do merely serves to make the trembling and nervousness worse. In all other respects he considered himself well, and he had every appearance of being a hard-working, somewhat stolid and unemotional man.

Examination showed normal pupils and knee reflexes. His pulse was 84; the blood pressure somewhat high; the heart normal. An attempt to write his name resulted in an entirely legible but tremulous signature.

Diagnosis. It is difficult and unnecessary to give this condition a definite name. The fact of essential importance which the case illustrates is that an early impression apparently trifling in character may be the starting point of a condition persisting through life as a neurosis. In the case of this man, the attempt to write his name at the age of twenty, under circumstances to him of peculiar embarrass-

ment, was sufficient to perpetuate by association a nervous disorder of so pronounced a character that he was wholly unable to rid himself of it through a long life of useful activity. As often happens in conditions of this type, after a varying period of time allied disorders manifested themselves in the form of tremor and agitation when he was called upon to perform other coördinated acts promptly or while under observation. This irradiation, as it were, of symptoms is an important matter to bear in mind in the analysis of such cases. By this means a primarily simple manifestation may often develop into a complexity exceedingly difficult to unravel.

Prognosis. Had it been possible to treat the condition on its earliest manifestation, there is little doubt that it could have been entirely relieved. After the lapse of thirty-seven years it is naturally very much more difficult to break up an association fixed by so long a period of repetition. It is, therefore, not to be expected that this patient will ever fully regain the necessary confidence in his capacity to write with equanimity under all circumstances which he lost at twenty.

Treatment. The patient was perfectly healthy in body and also in mind except for the idiosyncrasies mentioned in the foregoing history. Nothing is gained by drug treatment in such cases, and harm may often be done by impressing the patient with the inefficiency of methods in which he had hope, and in which the physician may have expressed confidence. A primary appeal to the reason, through explanation, and thereby the removal of apprehension as to the imagined significance of the incapacity, is the method to be employed. The results are often gratifying quite beyond expectation.

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